SAMPLING AND ANALYSIS PLAN/QUALITY ASSURANCE PROJECT PLAN FOR GOLD KING MINE LONG TERM MONITORING – OCTOBER/NOVEMBER 2015 SAMPLING EVENT SILVERTON, SAN JUAN COUNTY, COLORADO

Prepared for

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 8

1595 Wynkoop Street
Denver, CO 80202

Prepared by

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Contract No.: EP-S8-13-01

Technical Direction Document No.: 1510-02

October 2015

SAP/QAPP Revision Log

Project: Gold King Mine Blowout
Task Monitors: Steve Merritt
Technical Direction Document (TDD): 0001/1510-02

Date	Revision Number	Reason for Change of Scope/Procedures	SAP Section Superseded
10/23/15	1	Added sampling parameters; Updated sampling locations; added information for flow measurments and biota sampling	Worksheet 11, 12, 15, 17,18, 19

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LIST OF APPENDICES

Title

LIST OF ACRONYMS

°C	degrees Celsius
%D	percent difference
%R	percent recovery
%RSD	percent relative standard deviation
ACM	asbestos containing material
AES	Atomic Emission Spectrometry
ANSI	American National Standards Institute
APP	Accident Prevention Plan
ARAR	applicable or relevant and appropriate requirements
ASQ	American Society for Quality
AST	aboveground storage tank
B	bias
CA	Corrective Action
CB	calibration blank
CCB	continuing calibration blank
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHMM	Certified Hazardous Materials Manager
CLP	Contract Laboratory Program
cpm	counts per minute
CO	Contracting Officer
COC	Chain-of-Custody
COR	Contracting Officer Representative
Cr+6	Hexavalent Chromium
CRL	Central Regional Laboratory
CRQL	Contract Required Quantitation Limits
CSM	Conceptual Site Model
CVAA	Cold Vapor Atomic Absorption
D	absolute range
DMP/BMP	Region 8 Data Management Plan/Best Management Practices
DQI	Data Quality Indicator
DQO	Data Quality Objective
EDD	electronic data deliverable
EDX	Energy Dispersive X-Ray
ERM	Emergency Response Manager
ERT	Environmental Response Team
ESI	Expanded Site Inspection
FID	Flame Ionization Detector
FS	Feasibility Study
FSP	Field Sampling Plan
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
GIS	Geographic Information System
HASP	Health and Safety Plan
HRGC/HRMS	high resolution gas chromatography/high resolution mass spectrometry
HRGC/LRMS	high resolution gas chromatography/low resolution mass spectrometry
HRS	Hazard Ranking System
HPLC	high performance liquid chromatography
ICB	initial calibration blank

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LIST OF ACRONYMS

ICP	inductively coupled plasma
IDW	investigation-derived waste
ISTD	Instrument Standard
ITRC	Interstate Technology and Regulatory Council
LBP	lead based paint
LCS	laboratory control sample
LOD	limit of detection
LOQ	limit of quantitation
MDL	method detection limit
mg/kg	milligrams per kilogram
MPC	Measurement Performance Criteria
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable
NCP	National Contingency Plan
ND	non-detect
NIOSH	National Institute of Occupational Safety and Health
NPL	National Priorities List
NRCS	Natural Resource Conservation Service
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbons
PAL	Project Action Limit
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated Dibenzo-P-Dioxins
PCDF	Polychlorinated Dibenzofurans
PCM	Phase Contrast Microscopy
P.E.	Professional Engineer
PID	Photoionization Detector
PLM	polarized light microscopy
PM	Project Manager
PMP	Project Management Professional
POC	Point of Contact
PQL	Project Quantitation Limit
PQO	Project Quality Objectives
PT	proficiency testing
PTL	Project Team Lead
PUF	polyurethane foam
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QMP	Quality Management Plan
Ra	Radium
RA	Risk Assessment
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RL	reporting limit
RM	Removal Manager

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LIST OF ACRONYMS

RML	Removal Management Levels
RPD	relative percent difference
RSD	relative standard deviation
RSL	regional screening levels
SAP	Sampling and Analysis Plan
SAS	Special Analytical Services
SCDM	Superfund Chemical Data Matrix
SI	Site Inspection
SOP	Standard Operating Procedure
SRM	Standard Reference Material
SSDMP	Site-Specific Data Management Plan
SSL	soil screening level
START IV	Superfund Technical Assessment and Response Team 4
SVOC	Semi-volatile Organic Compounds
TAL	Target Analyte List
TBD	to-be-determined
TCL	Target Compound List
TDD	Technical Direction Document
TEM	transmission electron microscopy
TSA	Technical Systems Audit
UFP-QAPP	Uniform Federal Policy–Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
USGS	United States Department of the Interior Geologic Survey
UST	underground storage tank
VOC	Volatile Organic Compounds
WAM	Work Assignment Manager
WESTON	Weston Solutions, Inc.
XRD	x-ray diffraction
XRF	X-Ray Fluorescence

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EXECUTIVE SUMMARY

PROBLEM STATEMENT

The Gold King Mine site consists of a mine adit and waste rock piles in the Cement Creek watershed. The mine historically discharged low pH, metals-laden water at a flow rate of approximately 100 gallons per minute (gpm).

On August 5, 2015, EPA was conducting an investigation of the Gold King Mine (GKM) near Silverton, Colorado to assess the on-going water releases from the mine, treat mine water, and assess the feasibility of further mine remediation. While excavating above an old adit, pressurized water began leaking above the mine tunnel, spilling about three million gallons of water stored behind the collapsed material into Cement Creek, a tributary of the Animas River (http://www2.epa.gov/goldkingmine). The Animas River originates in the mountain peaks northeast of Silverton, in San Juan County, Colorado. It ends in Farmington, New Mexico, where it empties into the San Juan River terminating in Lake Powell in Utah.

Historically, EPA and the State of Colorado Division of Mining Reclamation and Safety (DRMS) had been working to control the existing flow from the Gold King Mine along with similar discharge that was emanating from the nearby Red and Bonita mine site. The project team was setting up to incorporate the flow from the Gold King Mine into the ongoing treatment of the flow from the Red and Bonita Mine when water that had been dammed in the Gold King Mine behind a collapsed section of adit broke through rock and debris.

PROJECT GOAL - The goal of the study is to evaluate long term conditions in waters downstream of the Gold King Mine site. This QAPP addresses the first sampling event described in the *Post-Gold King Mine Conceptual Monitoring Plan for Water, Sediment, and Biology (2015)* (GKM Monitoring Plan). The first sampling event will occur beginning in the last week of October 2015 through until the second week of November 2015. EPA has requested stakeholder input on the GKM Monitoring Plan and expects that changes will be incorporated into the plan after the first sampling event is complete. This QAPP will be updated to reflect these changes for any future sampling events.

PROJECT AREA - The study area includes the Gold King Mine site and downstream locations potentially impacted from the Gold King release including Cement Creek, the Animas River and the San Juan River.

PROJECT TASKS - EPA has requested that START assist to:

a. Collect samples from areas potentially affected by the release, including surface water, sediment, and biota.
b. Provide GPS data for sampling locations
c. Provide georeferenced site photodocumentation
d. Collect surface water flow measurements in conjunction with surface water sampling.
e. Collect field parameters in conjunction with surface water sampling.

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Introduction

This Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) identifies the data collection activities and associated QA/QC measures specific to the long term monitoring of areas downstream of the Gold King Mine site (the Site) located near Silverton, San Juan County, Colorado.

Sampling for this field mobilization related to the removal activities will consist of sampling at specific locations downstream from the Gold King Mine site (the Site(s) on the Cement Creek, Animas River and San Juan River. This SAP/QAPP has been prepared to complement the emergency response and removal activities for the site(s). Any deviations or modifications to the approved SAP/QAPP will be documented using the Revision Log.

This SAP/QAPP is produced in accordance with the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP). A QAPP is a formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP presents the steps that should be taken to ensure that environmental data collected are of the correct type and quality required for a specific decision or use. The UFP-QAPP is a consensus document prepared by the Intergovernmental Data Quality Task Force (IDQTF).

Addendums to this document will be issued if needed to address any new procedures required.

Project Organization and Team

Refer to the QAPP Worksheet 3 & 5, and 4, 7, & 8 for the program organizational chart, communication pathways, personnel responsibilities and qualifications, and special personnel training requirements. Project-specific information is provided below.

The following are key individuals identified for this project:

Name	Title/Role	Organization	Receive Copy of SAP?
Steve Merritt	OSC	EPA	Y
Sandra Spence	Water Quality Unit Chief	EPA	Y
Bryan Williams	Project Team Lead	START	Y
Jeff Bryniarski	Engineer	START	Y
John West	Engineer	START	Y
Jan Christner	Principal Engineer	START	Y
David Robinson	Project Manager	START	Y

The program QA Manager and the Project Manager will maintain the approved SAP/QAPP on file. The PTL will distribute the most current copy of the project QA documents via electronic or hard copy, as directed by the OSC. Files for this project will be kept in accordance with Section H.20 of Contract No.: EP-S8-13-01, stating a length of 10 years from close of the project or end of litigation.

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The following summarizes the relationship of the UFP-QAPP worksheets to the QA/G5 guidance.

Crosswalk: UFP-QAPP Workbook to 2106-G-05 QAPP

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
A. Project Management and Objectives			
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7, & 8	Personnel Qualifications and Sign-Off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certifications
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model (CSM)	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP ELEMENTS FOR EVALUATING EXISTING DATA
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
B. Measurement/Data Acquisition			
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field Quality Control (QC)	2.3.5	QC Requirements
21	Field Standard Operating Procedures (SOPs)	2.3.2	Sampling Procedures and Requirements

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Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical QC and Corrective Action	2.3.5	QC Requirements
29	Project Documents and Records	2.2.8	Document and Records Requirements
C. Assessment/Oversight			
31, 32, & 33	Assessments and Corrective Action	2.4	ASSESSMENTS AND DATAREVIEW (CHECK)
		2.5.5	Reports to Management
D. Data Review			
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedure	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

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Worksheet 1 & 2 — Title and Approval Page

(UFP-QAPP Manual Section 2.1)
(EPA 2106-G-05 Section 2.2.1)

1. Project Identifying Information

a) Site Name/Project Name: Gold King Mine Long Term Monitoring

b) Site Location/Number: Silverton, San Juan County, Colorado.

c) Contract/Work Assignment Number: EP-S8-13-01/TDD 1510-02

2) List Plans and reports from previous investigation relevant to this project.
Not applicable

Lead Investigative Organization's Program Manager:

W. Scott Butterfield, CHMM/WESTON
Printed Name/Title

Signature/Date

Lead Investigative Organization's Project Manager:

David Robinson/WESTON
Printed Name/Title

Signature/Date

Lead Investigative Organization's Delegated Quality Assurance Manager:

Tana Jones/WESTON
Printed Name/Title

Signature/Date

Federal Regulatory Agency On Scene Coordinator/Delgated Approval Officer:

Steve Merritt/EPA
Printed Name/Title

Signature/Date

Document Control Numbering System: W0285.1E.00710

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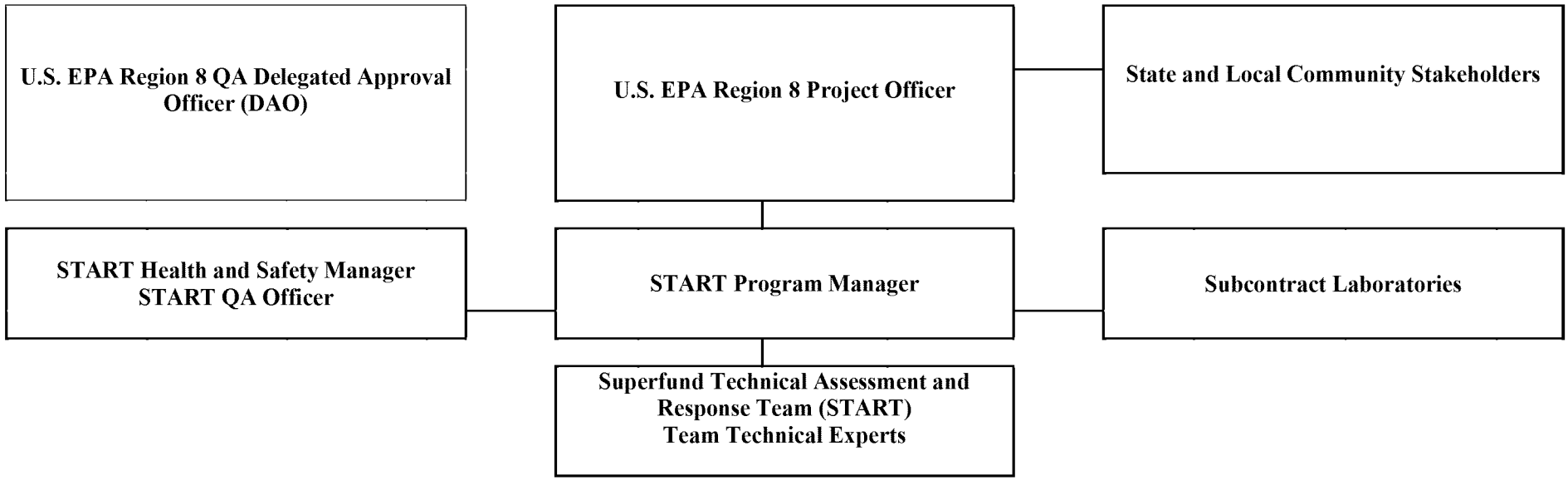
Worksheet 3 & 5 — Project Organization and QAPP Distribution

(UFP-QAPP Manual Section 2.3 and 2.4)
(EPA 2106-G-05 Section 2.2.3 and 2.2.4)

The most current and approved copy of the QAPP will be delivered to recipients using a web-based system in use by EPA and START at the time of submittal.



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Worksheet 4, 7 & 8 — Personnel Qualifications

(UFP-QAPP Manual Sections 2.3.2 - 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

Name	Project Title / Role	Education / Experience	Specialized Training / Certifications[1]	Training Provider[2]
W. Scott Butterfield, CHMM	Program Manager / Point of contact (POC) with EPA CO, COR, and Team Leader. Ensures adherence to contract and project requirements/deliverables.	B.S., Environmental Science, M.S., Zoology/Estuarine Ecology / 32 years of diversified technical and program management experience on EPA Superfund contracts.	FEMA IS Levels 100, 200, 700, and 800, and EPA Hazard Ranking System, Documentation Record, Preliminary Assessment, Site Inspection, Air Monitoring, Emergency Response, Level A Team, and Multi-Media Sampling / Certified Hazardous Materials Manager (CHMM)	WESTON, Registered Training Organization – Various
David Robinson	PM / Operational POC for project level communications with EPA Removal Managers (RMs) and Emergency Response Managers (ERMs), ensure performance associated with the contract, coordinate and communicate with EPA in the pre-planning phase of individual Technical Direction Document (TDD) assignments, provide technical direction to the Project Team Lead (PTL), and support any functions delegated by the Program Manager. Ensures all training/certifications are satisfied for field team personnel.	B.S., Chemistry / Over 25 years' environmental experience, 7 years experience on Region 5 START contracts.	FEMA IS Levels 100, 200, 300, 400, 700, and 800; 32-Hour Advanced Radiation Training; Response Readiness Training; Biological Response Training; Nuclear, Biological, and Chemical Emergency Responders Training; 40-Hour OSHA Hazardous Waste Site Worker Training; 8-Hour OSHA Refresher Training; First Aid and CPR	WESTON, Registered Training Organization – Various

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Name	Project Title / Role	Education / Experience	Specialized Training / Certifications[1]	Training Provider[2]
Mark Blanchard	PM/Technical Manager – POC for coordination with Removal Managers (RMs) for project planning and development. Work with PM, PTL and project team to coordinate field sampling events.	B.S., Geology, M.S. Geology, M.A.S., Environmental Policy / Over 20 years project management experience conducting site assessments, feasibility studies (FSs), and remedial design activities at Resource Conservation and Recovery Act (RCRA) / Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites.	40-Hour OSHA Hazardous Waste Site Worker Training; First Aid and Cardiopulmonary Resuscitation (CPR); Federal Emergency Management Agency (FEMA) IS Levels 100, 200, 300, 400, 700, and 800, Understanding Migration, Assessment, and Remediation of Non-aqueous Phase Liquids / Professional Geologist (P.G.) in Utah, Texas, and Nebraska, Leadership in Energy and Environmental Design Accredited Professional (LEED® AP)	WESTON, Registered Training Organization – Various
Tana Jones	Delegated QA Manager / Delegated authority for quality systems implementation and management, review and approval of quality documents, review and approval of contract deliverables, and performing quality assessments and quality systems audits. Maintains authority over implementation of quality systems management.	B.S., Natural Resource Management / Over 15 years' experience generating QAPPs, FSPs, SAPs, managing the sampling design; collecting, handling, documenting, and transporting samples; generating field documentation of sampling activities; manager of other field personnel, subcontractors; and review of collected analytical data on a variety of federal sites including Superfund/CERCLA sites.	FEMA IS Levels 100, 200, 700, and 800, Data Quality Objectives, Planning and Analysis using GIS / Project Management Professional (PMP)	WESTON, Registered Training Organization – Various

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Name	Project Title / Role	Education / Experience	Specialized Training / Certifications[1]	Training Provider[2]
Jan Christner, P.E.	Senior Engineer / Technical Manager – Provides technical oversight and document review. Address technical questions from field team.	B.S., Chemical Engineering, M.S. Environmental Science and Engineering / Over 18 years of environmental experience including emergency response; planning and preparedness; removal assessments and actions; and remedial assessments, evaluations, and actions	Professional Engineer (P.E.); Nuclear, Biological, and Chemical Emergency Responders Training; 40-Hour OSHA Hazardous Waste Site Worker Training; 8-Hour OSHA Refresher Training; First Aid and CPR	URS, WESTON, Registered Training Organization – Various
Bryan Williams	Biologist / Works with field team on planning for field sampling and evaluates sampling results.	B.A., Biology / over 20 years of project experience including conducting site assessments, Phase I ESAs, RFAs and RFIs, and HRS package prep.	40-Hour OSHA Hazardous Waste Site Worker Training; 30-Hour OSHA Field Supervisor Course; First Aid and CPR	Techlaw, Registered Training Organization – Various
Jeff Byrniarski	PTL / Supervises field sampling and coordinates all field activities.	B.S., Civil & Environmental Engineering / Over 9 years of project experience including conducting environmental sampling, Removal Actions, and Emergency Response.	40-Hour OSHA Hazardous Waste Site Worker Training; 8-Hour OSHA Refresher Training; Advanced Radiation Training 32-Hour RAD Worker; Niton XRF Spectrum Analyzer Training; FEMA IS Levels 100, 200, 300, 400, 700, and 800; First Aid and CPR.	WESTON, Registered Training Organization – Various
John West	PTL Alternate / Supervises field sampling and coordinates all field activities.	B.S., Geological Engineering / 14+ years of experience in the field of environmental sciences including Phase I/II ESAs, site investigations, assessments and removals.	40-Hour OSHA Hazardous Waste Site Worker Training; 8-Hour OSHA Refresher Training; First Aid and CPR. EPA and North Dakota Certified Asbestos Inspector.	WESTON, Registered Training Organization – Various

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Name	Project Title / Role	Education / Experience	Specialized Training / Certifications[1]	Training Provider[2]
Other field Technicians, Geologists, Environmental Scientists, Engineers as needed	TBD	TBD	40-Hour OSHA Hazardous Waste Site Worker Training; 8-Hour OSHA Refresher Training; First Aid and CPR	Registered Training Organization – Various

[1] Training records and/or certificates are on file at the Weston Solutions, Inc., West Chester, Pennsylvania office and are available upon request.

[2] Training provider and date of training will vary from person to person due to individual scheduling of training.

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Worksheet 6 — Communication Pathways

(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

Communication Drivers	Organization	Name	Contact Information	Procedures (Timing, Pathways, Documentation, etc.)
Regulatory Agency Interface	EPA CO	Maria Houston	303-312-7022	Maintain lines of communication between EPA Contracting Officer and WESTON Program Manager.
Approves Site-Specific QA Documents	EPA OSC/Task Monitor	Steve Merritt	303-312-6146	Approves site-specific FSPs, SAPs, and/or QAPPs in accordance with EPA guidance documents and policy. Provides guidance or instruction for site-specific QA documents.
POC with EPA CO	WESTON Program Manager	W. Scott Butterfield, CHMM	303-729-6113	Maintain lines of communication between EPA CO, WAM/COR and Team Leader.
Manage all Project Phases	WESTON PM	David Robinson	937-572-3630	Manage day to day operations of the project. Reports to Program Manager and EPA WAM/COR issues with cost, schedule, etc.
Health and Safety Monitoring/Reporting	WESTON Health and Safety Manager	David Robinson	937-572-3630	Communicates with PTL and PM regarding safety issues/reporting on a daily basis, when required.
QAPP Changes Prior to Field Work and Field and Analytical Corrective Actions	WESTON Delegated QA Manager	Tana Jones.	720-232-4399	Communicates changes to Removal Action and Emergency Response QAPP to QA Officer and site-specific FSPs, SAPs, and/or QAPPs to PM and EPA WAM/COR. Communicates with PTL to determine need for field and analytical corrective actions.
QAPP Changes in the Field and Daily Field Progress Reports	WESTON PTL	John West,	303-729-6148	Communicate QAPP changes and field activities to Delegated QA Manager, EPA WAM/COR, and PM on a daily basis, when required.
QAPP Amendments	WESTON QA Officer	Cecilia H. Shappee, P.E.	713-985-6701	Major changes to the Removal Action and Emergency Response QAPP must be approved by the QA Officer and Delegated QA Manager before implementation.
Data Tracking and Management, Release of Analytical Data	WESTON Data Manager	John Lucotch	970-301-1416	The need for corrective actions will be determined by the Delegated QA Manager upon review of the data. No analytical data will be released prior to validation and all releases must be approved by the Delegated QA Manager and EPA WAM/COR.

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Worksheet 6 — Communication Pathways (Continued)

(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

Communication Drivers	Organization	Name	Contact Information	Procedures (Timing, Pathways, Documentation, etc.)
Lab Data Quality Issues	Laboratory PM	Moira Pryhoda	303-729-6112	Laboratory PM will report any issues with project samples to the Delegated QA Manager within 2 business days.

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Worksheet 9 — Project Planning Session Summary

(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

Date: 9/29/15

Location: EPA Region 8 Office

Purpose: Discussion of anticipated sampling needs for Gold King Mine long term monitoring

Notes/Comments: Discussion focused on the Conceptual Monitoring Plan that EPA released for public comment. The objectives identified in the Conceptual Monitoring Plan are:

- Objective A: Identify changes in surface water or sediment quality trends since the GKM Release Incident in Cement Creek, Animas River, and the San Juan River by comparing post-release data against pre-release or historic trends. Only data that meet the requirements of Objective A, in that pre-release and post-release comparisons can be made, will be used to assess the changes since the GKM Release Incident.

- Objective B: Assess only current conditions of Cement Creek, Animas River, San Juan River, and Lake Powell where historic or pre-release data are absent or limited. Data solely collected to meet Objective B will not be sufficient in assessing the changes since the GKM Release Incident without additional information.

Consensus Decisions Made:

- START to prepare Draft SAP/QAPP based on the Conceptual Monitoring Plan
- Draft SAP/QAPP can be modified as needed if public comment requires adjusting the Conceptual Monitoring Plan

Action Items:

Action	Responsible Party	Due Date
Prepare site-specific Draft SAP/QAPP	START	10/9/15

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Worksheet 10 — Conceptual Site Model

(UFP-QAPP Manual Section 2.5.2)
(EPA 2106-G-05 Section 2.2.5)

Problem Definition

The Gold King Mine site consists of a mine adit and waste rock piles in the Cement Creek watershed. The mine historically discharged low pH, metals-laden water at a flow rate of approximately 100 gallons per minute (gpm).

On August 5, 2015, EPA was conducting an investigation of the Gold King Mine (GKM) near Silverton, Colorado to assess the on-going water releases from the mine, treat mine water, and assess the feasibility of further mine remediation. While excavating above an old adit, pressurized water began leaking above the mine tunnel, spilling about three million gallons of water stored behind the collapsed material into Cement Creek, a tributary of the Animas River (http://www2.epa.gov/goldkingmine). The Animas River originates in the mountain peaks northeast of Silverton, in San Juan County, Colorado. It ends in Farmington, New Mexico, where it empties into the San Juan River terminating in Lake Powell in Utah.

Historically, EPA and the State of Colorado Division of Mining Reclamation and Safety (DRMS) had been working to control the existing flow from the Gold King Mine along with similar discharge that was emanating from the nearby Red and Bonita mine site. The project team was setting up to incorporate the flow from the Gold King Mine into the ongoing treatment of the flow from the Red and Bonita Mine when water that had been dammed in the Gold King Mine behind a collapsed section of adit broke through rock and debris.

Background Information/Site History

The Gold King Mine is in the Cement Creek watershed, which originates high in the rugged San Juan Mountains of southwestern Colorado near the San Juan County and Ouray County line on the south slopes of Red Mountain Number 3 and the north slopes of Storm Peak.

The upper reaches of the Animas watershed are heavily impacted by historic mining activities and natural mineralization. Many abandoned mines exist within a two-mile radius in the headwaters including: the Upper Gold King, American Tunnel, Grand Mogul, Mogul, Red and Bonita, Eveline, Henrietta, Joe and John, and Lark mines. Some of these mines have acid mine drainages that produce flows of between 30 and 300 gallons per minute that directly or indirectly enter Cement Creek and eventually reach the Animas River. These flows were occurring prior to the GKM Release Incident and are ongoing. As a result, numerous remediation activities have been initiated in the watershed. The Animas River Stakeholder Group, the Bureau of Land Management, the Colorado Division of Reclamation/Mining and Safety, and EPA Region 8 have completed remediation projects in the watershed (EPA Region 8, Upper Animas Mining District: Draft Baseline Ecological Risk Assessment, http://www2.epa.gov/region8/upper-animas-mining-district-draft-baseline-ecological-risk-assessment). The Colorado Department of Public Health and the Environment has developed more than twenty-five Total Maximum Daily Loads (restoration plans required for waterbody segments considered impaired under the Clean Water Act) to help guide restoration activities towards meeting water quality standards. However, for some waters, including Cement Creek, the State has followed procedures under the Clean Water Act to remove aquatic life support as a designated use for the waterbody because it is not an

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attainable goal (Colorado Department of Public Health & Environment, https://www.colorado.gov/pacific/cdphe/tmdl-san-juan-and-dolores-river-basins).

Though restoration activities and plans have been underway in the watershed, aquatic life uses in numerous segments of the watershed remain impaired by heavy metals (Colorado Department of Public Health & Environment, https://www.colorado.gov/pacific/sites/default/files/Regulation-93.pdf). The Animas River Stakeholders Group (ARSG), which updated a watershed plan for remediating historical mining sites in the Upper Animas River Basin in 2013, estimates that in recent years untreated acid mine drainage from Cement Creek alone has been in the range of 600-800 gallons per minute or about 314-420 million gallons per year, with increases in metals loadings observed 40 miles downstream in the Animas River (http://ofmpub.epa.gov/apex/grts/f?p=110:700:13401198170892::NO:RP,700:P700_PRJ_SEQ:62860).

The rugged and relatively inaccessible western San Juan Mountains were first prospected in the area around Silverton in 1860. The extension of the railroad from Silverton up Cement Creek to Gladstone in 1899 encouraged the mining of low grade ores, and the establishment of a lead-zinc flotation plant in 1917 allowed for the treatment of the low grade complex ores found in the area. Over a 100-year period between 1890 and 1991, mining activities in the upper Animas River Basin, including Cement Creek, produced the waste rock and mill tailings sources from which contamination spread throughout the surface water pathway. Over 18 million tons of ore were mined from the Upper Animas River Basin area, with more than 95 percent of this being dumped directly into the Animas River and its tributaries in the form of mill waste. Older waste rock piles and stope fillings were reworked and sent to mills as technology allowed lower grade ores to be processed economically. A great deal of abandoned waste was also milled during World War II when many older mining and milling structures were cannibalized for scrap metal. The last producing mine in the area was the Sunnyside Mine, which ceased production in 1991. The closing of the Sunnyside mine occurred after Lake Emma drained into the mine and out the American Tunnel into Cement Creek in 1978. The flood water from the Lake Emma "blow-out" was reported to have flowed down Cement Creek in a 10-foot wall of water that would have transported a large quantity of tailings and other mine waste down Cement Creek to the Animas River.

Numerous historic and now abandoned mines exist within a two-mile radius of Gladstone. They include: the Upper Gold King 7 Level, American Tunnel, Grand Mogul, Mogul, Red and Bonita, Evelyne, Henrietta, Joe and John, and Lark mines. Some of these mines have acid mine drainage that flows between 30 and 300 gpm directly or indirectly into Cement Creek and eventually into the Animas River. The confluence of Cement Creek and the Animas River is located approximately eight miles downstream of Gladstone.

The Animas River Stakeholders Group (ARSG), U.S. Bureau of Land Management (BLM), DRMS, EPA, and private stakeholders have participated in various projects to manage mine waste and to reduce the flow of contaminated water in the watershed. In addition, under the terms of a consent decree with the State of Colorado, Sunnyside Gold Mine Company performed several large scale projects related to historic operations on properties associated with the company's operations. One project was plugging (installing concrete bulkheads) within the Sunnyside mine workings, including the American Tunnel, during the period from 1996 to 2002. The American Tunnel is located in Gladstone, approximately ¾ to 1 mile south of the Red and Bonita and Gold King mines. During the mine operation, the American Tunnel discharged approximately 1,700 gpm of metal laden water and was treated prior discharging to Cement Creek. Following the installation of the last of the three plugs,

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flow from the American Tunnel has decreased to approximately 100 gpm, the result of leakage around the concrete bulkhead. The flow from the Red and Bonita Mine, the Gold King (Level 7) Mine, and the Mogul Mine all experienced significant increases in flow following the plugging of the American Tunnel.

Contaminants found in the Red and Bonita discharge water include low pH and metals. Cadmium concentrations from the mine discharge ranged from 33.3 micrograms per liter (µg/L) to 39.3 µg/L, copper concentrations ranged from 4.5 µg/L to 50.6 µg/L, iron concentrations range from 76,700 µg/L to 97,600 µg/L, lead concentrations ranged from 34 µg/L to 71.2 µg/L, and zinc concentrations ranged from 13,600 µg/L to 17,500 µg/L.

Contaminants in the Gold King discharge water include low pH and metals. From 2009 to 2011, cadmium concentrations from the mine discharge ranged from 38 micrograms per liter (µg/L) to 136 µg/L, copper concentrations ranged from 2400 µg/L to 12,000 µg/L, lead concentrations ranged from 2 µg/L to 29 µg/L, and zinc concentrations ranged from 14,500 µg/L to 44,700 µg/L.

Background Reference:

- URS Operating Services, Inc. 2010. Red and Bonita Mine Remedial Action Field Sampling Plan. October 2010.
- Weston Solutions Inc., 2014. Sampling and Analysis Plan for Red and Bonita Mine. Nov 2014.
- Weston Solutions, Inc., 2015. Sampling and Analysis Plan/Quality Assurance Project Plan for the Gold King Mine Release.

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Worksheet 11 — Project/Data Quality Objectives

(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

Data quality objectives are based on the following seven steps.

State the Problem

This monitoring study is designed to collect data in the surface waterbodies potentially impacted by the GKM Release Incident to determine if water and sediment quality trends are similar to trends observed before the GKM release. While the latest monitoring information after the GKM Release Incident shows contaminant levels have returned to pre-spill levels, this study's monitoring information will serve to inform if these findings remain consistent across the range of annual flow conditions. This QAPP addresses the first sampling event described in the *Post-Gold King Mine Conceptual Monitoring Plan for Water, Sediment, and Biology (2015)* (GKM Monitoring Plan). The first sampling event will occur beginning in the last week of October 2015 through the third week of November 2015. EPA has requested stakeholder input on the GKM Monitoring Plan and expects that changes will be incorporated into the plan after the first sampling event is complete. This QAPP will be updated to reflect these changes for any future sampling events.

It is important to recognize that the information collected for this monitoring study may not be sufficient to attribute elevated contaminant levels or possible biological metrics to the August 5, 2015, GKM release. The limits of this study's data to provide release-specific attribution follow from the many years of historic mine drainage releases from the GKM, the ongoing acid mine drainage releases from other mines into the Animas River (and downstream water bodies) and the limited availability of prerelease water quality conditions.
EPA has requested that START assist to:

a. Collect samples from areas potentially affected by the release, including surface water, sediment, and biota.

b. Provide GPS data for sampling locations

c. Provide georeferenced site photodocumentation

d. Collect surface water flow measurements in conjunction with surface water sampling.

e. Collect field parameters in conjunction with surface water sampling.

Identify the Goals of the Study

The goals of the study are to:

- Objective A: Identify changes in surface water or sediment quality trends since the GKM Release Incident in Cement Creek, Animas River, and the San Juan River by comparing post-release data against pre-release or historic trends. Only data that meet the requirements of Objective A, in that pre-release and post-release

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comparisons can be made, will be used to assess the changes since the GKM Release Incident.

- Objective B: Assess current conditions of Cement Creek, Animas River, San Juan River, and Lake Powell where historic or pre-release data are absent or limited. Data solely collected to meet Objective B will not be sufficient in assessing the changes since the GKM Release Incident without additional information.

Identify Information Inputs

To support the above objectives, the following data will be collected:

- Surface water and sediment samples will be collected and submitted for laboratory analysis.
- Biologic samples will be collected and submitted for analysis.
- Field measurements of surface water quality.
- Field measurements of surface water flow.
- Geospatial data of sampling locations.
- Field documentation and photographs of site activities.

Define the Boundaries of the Study

Spatial Boundaries: The study area includes the Gold King Mine site and downstream locations potentially impacted from the Gold King release.

Temporal Boundaries: The EPA anticipates that the sampling under this strategy will occur during the first year after completion of the GKM Release Incident response monitoring activities conclude. This monitoring and assessment effort will end after approximately one year if data confirm that pre-release trends or screening levels are maintained. A one-year monitoring duration was selected so that data may be collected across the full range of seasonal flow conditions.A sampling schedule and sampling plan is included in Worksheets 14, 16 and 17. This QAPP addresses the first sampling event for this plan.

Practical constraints on data collection: Scheduling adjustments will be made if physical constraints on planned field events occur due to weather, safety considerations, or problems that may impact the technical quality of the measurements.

Develop the Analytic Approach

Samples will be collected from locations designated in the field by an EPA OSC. Samples will be sent for laboratory analysis as directed by the OSC.

The following analytical and field methods are proposed for sample collection and analysis under this monitoring strategy:

1. Dissolved metals in water

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- Commercial lab - ICP-MS Dissolved Metals in Water (EPA 200.8) and ICP Dissolved Metals in Water (EPA 200.7)

2. Total recoverable metals in water
   - ICP-MS Total Metals in Water (EPA 200.8) and ICP Total Metals in Water (EPA 200.7)
3. Mercury
   - EPA 245.1
4. Dissolved orangic carbon (DOC)
   - EPA 415.2
5. Total organic carbon (TOC)
   - EPA 415.1
6. Hardness
   - SM 2340B
7. Total recoverable metals in sediment
   - ICP-MS Total Metals in Soil (EPA 200.8) and ICP Total Metals in Soil (EPA 200.7)
8. Alkalinity
   - EPA 310.2 Alkalinity Colorimeteric, Automated – or equivalent
9. Total Suspended Solids
   - EPA 160.2 Total Suspended Solids/Residue, Non-Filterable (Gravimetric, Dried at 103-105° C)
10. Macroinvertebrate Identification
    - Colorado Department of Public Health and Environment Policy 10-1 and Standard Operating Procedure for Macroinvertebrate Identification https://www.colorado.gov/pacific/sites/default/files/T1_WQCC_Policy10-1.pdf

These methods are based on utilizing a subcontracted commercial analytical laboratory. If samples are directed to a CLP laboratory the equivalent CLP methods will be utilized.

Screening levels that were used for the GKM Release Incident response decisions will be used in data assessment under this strategy as well. Federally approved applicable State and Tribal water quality standards can be found at:

- State of Colorado –
  - ftp://ft.dphe.state.co.us/wqc/wqcc/Current%20Water%20Qualitly%20Standards/Currently%20Effective%20Standards/34_SanJuan_Effective_06-30-2015/34_2015(06)SBP.pdf
  - https://www.colorado.gov/pacific/sites/default/files/T1_WQCC_Policy10-1.pdf
- Navajo Nation –
  - http://www.navajonationepa.org/Pdf%20files/Navajo%20Nation%20Surface%20Water%20Quality%20Standards%202007.pdf
- Southern Ute Tribe -
  - Contact the tribe - https://www.southernute-nsn.gov/environmental-programs/waterquality/ or EPA Region 8 – 303-312-6947
- State of New Mexico –

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- http://164.64.110.239/nmac/parts/title20/20.006.0004.pdf
- State of Utah –
  - http://www.rules.utah.gov/publicat/code/r317/r317-002.htm
- Ute Mountain Ute Tribe –
  - http://www.utemountainuteenvironmental.org/umep/assets/File/Water/Surface%20Water%20Standards/UMU_WQS_2011Revision_042011_supplimental.pdf

Specify Performance or Acceptance Criteria

All data will be reviewed and verified to ensure that they are acceptable for the intended use. Data will be validated at the request of the EPA OSC.

Decision errors will be limited to the extent practicable by following approved U.S. EPA methods and applicable SOPs listed in Worksheet #21. Any deviation from the SAP will be documented.

Develop the Detailed Plan for Obtaining Data

Water, sediment, and biologic samples will be collected at locations designated by the EPA OSC. Worksheets 17, 18, 20, and 21 present the sampling design and procedures.

Final site selection will be based upon the assessment needs and goals of EPA, key stakeholders and regulatory partners. Anticipated locations are listed on Worksheet 18.

Field water quality parameters will be obtained using a Horiba (U50 or U53) or similar water quality meter. Field monitoring will be used to measure the quality of water, with emphasis on pH measurements. Visual observations of water clarity will be recorded.

Worksheets 19, 20, 24-28 and 30 specify analytical requirements. Data from the laboratories will be delivered in an electronic data deliverable and reported in the site activities report. A site-specific Data Management Plan is provided in Appendix B.

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Worksheet 12 — Measurement Performance Criteria Tables

(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

The following are typical examples for Inorganics for all media.

Matrix: All
Analytical Group or Method: Inorganics
Concentration Level: All

DQI	QC Sample or Measurement Performance Activity	MPC
Field Precision	Field Duplicate	1 per 10 samples RPD determined on a sampling method-specific basis
Field Representativeness/ Accuracy/Bias	Equipment Rinsate Blank	1 per 20 samples/matrix or 1 per day <½ LOQ
Accuracy/Bias	MS/MSD	1 per 20 samples per matrix RPD <20%
Laboratory Precision	Laboratory Duplicate	1 per 20 samples per matrix RPD <20%
Accuracy/Precision	Initial Calibration	Daily prior to sample analysis (minimum 1 standard and a blank)
Accuracy/Bias	Initial Calibration Verification	Daily after initial calibration All analytes within ±10% of expected value
Accuracy/Bias	Calibration Blank (CB) Initial Calibration Blank/Continuing Calibration Blank (ICB/CCB)	After every calibration/verification No analytes detected ≥ Limit of Detection (LOD)
Precision/Accuracy	Calibration Verification (Instrument Check Standard)	At beginning of analytical sequence, after every 10 samples and at the end of the analysis sequence All analytes within ±10% of expected value and RSD of replicate integrations <5%
Precision	Interference Check Solution	At beginning of analytical run ± 20% of the expected value
Precision/Accuracy	Serial Dilution	Method-specific
Accuracy/Bias	Post Digestion Blank	Each digestion batch %R. Analyte-specific
Laboratory Representativeness/ Accuracy/Bias	Method Blank	1 per batch per matrix or 1 per 20 samples, whichever is more frequent No analyte ≥ RL
Laboratory Accuracy/ Sensitivity	LCS	1 per batch per matrix or 1 per 20 samples, whichever is more frequent No analyte ≥ LOQ

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Matrix: All
Analytical Group or Method: Organics
Concentration Level: All

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Field Precision	Field Duplicate	1 per 10 samples relative percent difference (RPD) determined on a sampling method-specific basis
Field Representativeness/ Accuracy/Bias	Equipment Rinsate Blank	1 per 20 samples/matrix or 1 per day <½ Reporting Limit (limit of quantitation [LOQ])
Accuracy/Bias	Trip Blanks	<½ LOQ
Accuracy/ Precision	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One set per extraction batch when sufficient sample volume is provided or as requested per client Analyte-specific
Laboratory Precision	Laboratory Duplicate	1 per 20 samples per matrix Analyte-specific
Accuracy/Precision	High Calibration Standard	All analytes within ±15% of expected value
Accuracy/Precision	Initial Calibration	Five-point calibration for all analytes prior to sample analysis. Mean relative standard deviation (RSD) for all analytes < 20% Correlation Coefficient R ≥ 0.995
Accuracy/Bias	Initial Calibration Verification	After each initial calibration Within ±20% of expected value
Precision	Continuing Calibration Verification	After every 20 samples and at end of sequence All analytes within ±20% of expected value
Accuracy/Bias	Surrogate	Every sample <½ LOQ. Project and method-specific
Laboratory Representativeness/ Accuracy/Bias	Method Blank	1 per batch per matrix or 1 per 20 samples, whichever is more frequent <½ LOQ
Laboratory Accuracy/Sensitivity	Laboratory Control Sample (LCS)	1 per batch per matrix or 1 per 20 samples, whichever is more frequent No analyte ≥ LOQ

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Matrix: Biota
Analytical Group or Method: Macroinvertebrates
Concentration Level: All

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Field Precision	Field Duplicate	1 per 10 samples relative percent difference (RPD) determined on a sampling method-specific basis
Field Representativeness	Habitat Selection	Habitat sampled as directed in SOP/Methods
Representativeness	Macroinvertebrate Pick Minimum of 300	Analyst to pick a minimum 300 count or total pick across 15 grids
Accuracy/Bias	Secondary Macroinvertebrate Pick Verification	1 per 10 samples; < 5% total organisms count remains, requires corrective action of repick
Accuracy/ Precision	Secondary Taxonomic Verification	1 per 10 samples; < 5% total organisms id error, requires corrective action
Laboratory Precision	Laboratory Duplicate	1 per 10 samples; < 5% total organisms id error, requires corrective action
Laboratory Accuracy	External taxonomic verification	For unusual specimens, or if in-house secondary taxonomic error rate exceeds 5% without resolution

Matrix: Field Measurements
Analytical Group or Method: Flow Meter Discharge Measurment
Concentration Level: All

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Field Precision	Field Duplicate	1 per 10 locations relative percent difference (RPD) 20%
Field Representativeness	Cross Section Selection	EPA Region 8 SOP FLDM-722 describes site selection considerations
Accuracy/Bias	Instrument Zero	Zero adjust calibaration procedure – once anually
Field Accuracy/ Precision	10% Rule	Calculated discharge at any one measurement vertical <10% of total discharge – flag as estimate if exceeded.

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Worksheet 13 — Secondary Data Uses and Limitations

(UFP-QAPP Manual Section 2.7)
(EPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

Sources and types of secondary data include but are not limited to the following:

Data Type	Data Source (originating organization, report title and date)	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Soils	United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Web Soil Survey and Soil Data Mart	Identify soil types, composition, elevation, precipitation, setting, properties and qualities, profile, land capability and farmland classification	
Geology/Hydrology	United States Department of the Interior Geologic Survey (USGS) Topographic and Geologic Maps, State Agencies/EPA My WATERS Mapper	Identify area Geology, topography, surface water bodies, hydrologic units/watersheds, water quality, etc.	
Streams/Drainages	EPA My WATERS Mapper and USGS Topographic Maps	Topography, surface water bodies, hydrologic units/watersheds, water quality, etc.	
Registered Wells	State Databases	Identify well locations, drinking water wells, and groundwater use	
Meteorological	National Weather Service	Seasonal fluctuations in storm water runoff	
Property Boundaries	County Assessor and Plat Maps	Identify property boundaries to determine site requirements for assessment	
Environmentally Sensitive Areas	U.S. and State Fish & Wildlife Service Maps, Publications, and Databases	Identify sensitive and endangered species and environments potentially present on or in removal action/emergency response area	
Wetlands	USDA NRCS Web Soil Survey and Soil Data Mart (Hydric Soils List), and U.S. and State Fish & Wildlife Databases	Identify wetlands and associated sensitive and endangered species and environments potentially present on or in removal action/emergency response area	
Historical and Current Site Use and Investigations	Historical Records, Previous Investigations, Visual Site Reconnaissance, and Interviews	Supplemental background information on historical site use and current site conditions, and previous investigations	

The project team will carefully evaluate the quality of secondary data (in terms of precision, bias, representativeness, comparability, and completeness) to ensure they are of the type and quality necessary to support their intended uses. When evaluating the reliability of secondary data and determining limitations on their uses, the project team will consider the source of the data, the time period during which they were collected, data collection methods, potential sources of uncertainty, the type of supporting documentation

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Worksheet 13 — Secondary Data Uses and Limitations (Continued)

(UFP-QAPP Manual Section 2.7)
(EPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

available, and the comparability of data collection methods to the currently proposed methods. With respect to secondary analytical data that will be utilized to support critical decisions, such as comparison of contaminant levels with applicable standards, a detailed review of the data will be necessary to determine the usability of the data. In addition to the qualitative rating of the data source, the project team should complete a data quality review and document the review in a data usability summary. The protocol for completing the data usability report is provided in Worksheet 37.

In accordance with EPA guidance documents *A Summary of General Assessment Factors for Evaluating the Quality of Scientific and Technical Information* (June 2003) and *Guidance for Evaluating and Documenting the Quality of Existing Scientific and Technical Information* (December 2012) (Appendix Q), the following assessment factors will be utilized to assess the quality and relevance of scientific and technical information:

1. **Soundness** – the extent to which the scientific and technical procedures, measures, methods or models employed to generate the information are reasonable for, and consistent with, the intended application.
2. **Applicability and Utility** – the extent to which the information is relevant for the Agency's intended use.
3. **Clarity and Completeness** – the degree of clarity and completeness with which the data, assumptions, methods, quality assurance, sponsoring organizations and analyses employed to generate the information are documented.
4. **Uncertainty and Variability** – the extent to which the variability and uncertainty (quantitative and qualitative) in the information or in the procedures, measures, methods or models are evaluated and characterized.
5. **Evaluation and Review** – the extent of independent verification, validation and peer review of the information or of the procedures, measures, methods or models.

The type of information, sources of information and quantity of information will be project-specific. The following table can be utilized and/or modified as appropriate in the development of the site-specific FSP, SAP and/or QAPP and site report to capture the review of the secondary data assessment factors. Assessment factors will be rated as Acceptable, Marginal, Unacceptable, Not Applicable, or Indeterminate.

Citation	Reference Type	Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review

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Worksheet 14 & 16 —Project Tasks & Schedule

(UFP-QAPP Manual Section 2.8.2)
(EPA 2106-G-05 Section 2.2.4)

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Project Initiation	EPA/START	October 1, 2015	September 30, 2016	N/A	N/A
Develop a SAP for Removal and Emergency Response Activities and the EPA Region 8 QA Document Review Crosswalk	START	October 1, 2015	October 9, 2015	Develop a SAP for Removal and Emergency Response Activities and the EPA Region 8 QA Document Review Crosswalk	October 9, 2015
Develop Health and Safety Plan (HASP)	START	October 12, 2015	October 16, 2015	HASP	N/A
Mobilization/Demobilization	START	Fall 2015	Fall 2015	Field Notes	N/A
Sample Collection Tasks	START	Fall 2015	Fall 2015	Field Notes	N/A
Analytical Tasks	START/ Laboratory	Fall 2015	Fall 2015	Field Notes/Laboratory Reports	N/A
Quality Control Tasks	START	Fall 2015	Fall 2015	Report of Analyses/Data Package	N/A
Validation	START	Winter 2015	Winter 2015	Validation Summary Report	N/A

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Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Summarize Data	START	Winter 2015	Winter 2015	Trip Reports	TBD

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Worksheet 15 — Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

(UFP-QAPP Manual Sections 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

The following information provides representative benchmarks that may be useful for comparison of analytical sample results. Due to the ongoing nature of the project, multiple benchmarks may be appropriate for comparison. Benchmarks utilized for data analysis and reporting will be documented within each report. Multiple laboratories may be utilized. Quantitation and detection limits may vary between laboratories based on localized equipment.

Screening levels that were used for the GKM Release Incident response decisions will be used in data assessment under this strategy as well. Federally approved applicable State and Tribal water quality standards can be found at:

- State of Colorado –
  - ftp://ft.dphe.state.co.us/wqc/wqcc/Current%20Water%20Qualitly%20Standards/Currently%20Effective%20Standards/34_SanJuan_Effective_06-30-2015/34_2015(06)SBP.pdf
  - https://www.colorado.gov/pacific/sites/default/files/T1_WQCC_Policy10-1.pdf
- Navajo Nation –
  - http://www.navajonationepa.org/Pdf%20files/Navajo%20Nation%20Surface%20Water%20Quality%20Standards%202007.pdf
- Southern Ute Tribe -
  - Contact the tribe - https://www.southernute-nsn.gov/environmental-programs/waterquality/ or EPA Region 8 – 303-312-6947
- State of New Mexico –
  - http://164.64.110.239/nmac/parts/title20/20.006.0004.pdf
- State of Utah –
  - http://www.rules.utah.gov/publicat/code/r317/r317-002.htm
- Ute Mountain Ute Tribe –
  - http://www.utemountainuteenvironmental.org/umep/assets/File/Water/Surface%20Water%20Standards/UMU_WQS_2011Revision_042011_supplimental.pdf

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Matrix: Water
Analytical Method: 200.7, 200.8, 245.1
Concentration level (if applicable): Low to High

Anticipated quantitation limits based on methods and previous work conducted as part of the Gold King Mine release response are provided below.

Analyte	Project Quantitation Limit (PQL) Goal	Laboratory Quantitation Limit (LQL)[1]	Laboratory Detection Limit (LDL)[1]
Total Metals (ug/L)			
Aluminum	200	200	24
Antimony	20	20	5.3
Arsenic	20	20	6.2
Barium	10	10	1.7
Beryllium	4	4	0.1
Cadmium	5	5	1
Calcium	500	500	25
Chromium	10	10	1.6
Cobalt	10	10	1
Copper	20	20	1.8
Iron	50	50	17
Lead	10	10	3.9
Magnesium	500	500	33
Manganese	10	10	1
Mercury	0.2	0.2	0.08
Molybdenum	10	10	1
Nickel	40	40	2.1
Potassium	1000	1000	17
Selenium	20	20	9.9
Silver	10	10	0.6
Sodium	1000	1000	480
Thallium	25	25	6
Vanadium	10	10	1
Zinc	20	20	7
Dissolved Metals (ug/L)			
Aluminum	200	200	24
Antimony	20	20	5.3
Arsenic	20	20	6.2
Barium	10	10	1.7
Beryllium	4	4	0.1
Cadmium	5	5	1
Calcium	500	500	25
Chromium	10	10	1.6
Cobalt	10	10	1
Copper	20	20	1.8
Iron	50	50	17
Lead	10	10	3.9

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Analyte	Project Quantitation Limit (PQL) Goal	Laboratory Quantitation Limit (LQL)[1]	Laboratory Detection Limit (LDL)[1]
Magnesium	500	500	33
Manganese	10	10	1
Mercury	0.2	0.2	0.08
Molybdenum	10	10	1
Nickel	40	40	2.1
Potassium	1000	1000	17
Selenium	20	20	9.9
Silver	10	10	0.6
Sodium	1000	1000	480
Thallium	25	25	6
Vanadium	10	10	1
Zinc	20	20	7
Total Suspended Solids	4 mg/L	4 mg/L	2.0 mg/L
Alkalinity	2 mg/L	2 mg/L	0.56 mg/L
Organic Parameters (mg/L)			
Total Organic Carbon	1	1	0.5
Dissolved Organic Carbon	1	1	0.1

[1] Terminology is project/laboratory-specific.

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Matrix: Soil
Analytical Method: 200.7, 200.8, 245.1
Concentration level (if applicable): Low to High

Analyte	Project Quantitation Limit (PQL) Goal	Laboratory Quantitation Limit (LQL)[1]	Laboratory Detection Limit (LDL)[1]
Total Metals (mg/Kg)			
Aluminum	20	20	3.1
Antimony	2	2	0.82
Arsenic	2	2	0.8
Barium	1	1	0.16
Beryllium	0.4	0.4	0.01
Cadmium	0.5	0.5	0.1
Calcium	50	50	5.2
Chromium	1	1	0.21
Cobalt	1	1	0.1
Copper	2.5	2.5	0.17
Iron	20	20	5.3
Lead	1	1	0.34
Magnesium	50	50	8.9
Manganese	1	1	0.1
Mercury	0.02	0.02	0.008
Nickel	4	4	0.38
Potassium	100	100	2.5
Selenium	2.5	2.5	0.97
Silver	1	1	0.06
Sodium	200	200	48
Thallium	2.5	2.5	0.6
Vanadium	1	1	0.1
Zinc	2	2	0.7

[1] Terminology is project/laboratory-specific.

Matrix: Biota
Analytical Method: Macroinvertebrate

Analyte	Laboratory Detection Limit (LDL)[1]
All Organimsms	Lowest taxonomic level based on current literature
Chironomids	Genus or species unless early instar for which subfamily or tribe is acceptable

[1] Terminology is project/laboratory-specific.

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Worksheet 17 — Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

START will collect surface water, sediment and biological samples to characterize water quality and potential impacts from the Gold King Mine release.

This project involves the collection of laboratory samples and field screening. Sample points will be located with a Global Positioning System (GPS) device to be used for mapping purposes and to document sample locations selected in the field. If sampling locations become inaccessible, alternate sampling locations which provide similarly adequate or sufficient data as the original will be identified and sampled based upon the best judgment of the inspector/sampler, if necessary.

Sample Locations and Nomenclature

Sample locations will be identified in the field in coordination with the EPA OSC. Worksheet 18 includes potential sampling locations for the monitoring described in this plan. Final site selection will be based upon the assessment needs and goals of EPA, key stakeholders and regulatory partners. Replacement sites with pre-release or historic data may also be considered. Appendix C provides the Conceptual Work Plan with associated maps for these locations. Maps will be finalized once site selection is complete.

Sampling and Field QC Procedures

Samples will be analyzed for the parameters listed on Worksheet 15. Additional parameters may be added if directed by the OSC. Requirements for the sample container, volume, preservation, and QC samples are presented on Worksheet 19 & 30 of the QAPP.

Sampling and analytical activities performed on site will follow all applicable SOPs outlined in Worksheet 21, including EPA ERT SOP 2001 "General Field Sampling Guidelines". Sampling is anticipated to be performed in Level D personal protective equipment (PPE).

Samples will be collected using equipment and procedures appropriate to the matrix, parameters, and sampling objectives. The volume of the sample collected will be sufficient to perform the analysis requested. Samples will be stored in the proper types of containers and preserved in a manner for the analysis to be performed per laboratory guidelines.

Field water quality parameters will be obtained using a Horiba water quality meter. Field monitoring will be used to measure the quality of water discharged from the treatment system, with emphasis on pH and turbidity measurements. Visual observations of water clarity will be recorded.

Dedicated sampling equipment, sample containers, and PPE will be maintained in a clean, segregated area. Personnel responsible for sampling will change gloves between each sample collection/handling activity. Personnel will use unpowdered nitrile gloves as some types of powder in the powdered gloves contain zinc which could potentially contaminate samples.

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START personnel will collect field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples and QA/QC samples as needed during the sampling activities. QA/QC samples will be collected according to the following and summarized on Worksheet 20:

- Blind field duplicate water samples will be collected during sampling activities at locations selected by the START PTL. The data obtained from these samples will be used to assist in the quality assurance of the sampling procedures and laboratory analytical data by allowing an evaluation of reproducibility of results. Efforts will be made to collect duplicate samples in locations where there is visual evidence of contamination or where contamination is suspected. One duplicate sample will be collected for this sampling activity. In general blind field duplicate samples are collected at the rate of one duplicate for every 10 samples collected.
- Field Blank - Field blanks will be prepared by pouring de-ionized water into pre-cleaned laboratory-grade sample containers for analysis. If samples are field filtered for dissolved metals and mercury, the deionized water will be run through the same type of filtration device as the field samples. These samples will be prepared to demonstrate the impact the surrounding environment is having on the samples being collected. Field blank samples will be collected once per day for this particular scope of work.
- Temperature Blanks - Each sample cooler shall contain a temperature blank. The temperature blank should be supplied by the receiving laboratory and can a plastic bottle filled with water. The purpose of the temperature blank is to document the temperature of the representative solution contained within the same transport cooler as the collected field sample.
- Equipment Rinsate Blanks - Rinsate blanks will be prepared by pouring de-ionized water over non-disposable sampling equipment after it has been decontaminated and by collecting the rinse water in sample containers for analyses. These samples will be prepared to demonstrate that the equipment decontamination procedures for the sampling equipment were performed effectively. It is anticipated that enough pre-cleaned disposable equipment will be available and that the collection of an equipment rinsate blank will not be needed during this sampling event. However if field conditions change, an equipment rinsate blank will be collected following equipment decontamination procedures.
- Matrix spike (MS) samples will be collected during sampling activities at locations selected by the START PTL. The data obtained from these samples will be used to assist in the quality assurance of the laboratory analytical procedure. Matrix spiking ensures that the laboratory is able to extract an acceptable percentage of a spiked constituent. At the direction of EPA, one matrix spike sample may be collected for every 20 samples submitted for analysis. The matrix spiking analysis often duplicates the spiking procedure on a separate sample volume (MSD).

Biological Sampling

Sample collection procedures will be based on those in the EPA National Rivers and Streams Assessment Field Operations Manual (FOM) (EPA-841-B-07- 009)(EPA, 2009a) and Colorado Department of Public Health and Environment Policy 10-1 and SOPs for macroinvertebrate sample collection and identification.

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https://www.colorado.gov/pacific/sites/default/files/T1_WQCC_Policy10-1.pdf. Requirements for the sample container, volume, preservation, and QC samples are presented in the FOM (EPA, 2009a). START personnel will collect field duplicate and QA/QC samples as needed during the sampling activities based on the criteria outlined in the FOM (EPA, 2009a). Samples may be analyzed for biologicals using the methods described in the FOM and the National Rivers and Streams Assessment: Laboratory Methods Manual (EPA-841-B- 07-010) (EPA, 2009a; 2009b).

Supporting documents that may be used in conjunction with the aforementioned sampling and analytical guidance include: National Rivers and Streams Assessment: Quality Assurance Project Plan (EPA-841-B- 07-007) (EPA, 2010), National Rivers and Streams Assessment: Site Evaluation Guidelines (EPA-841-B-07- 008) (EPA, 2009c), and National Rivers and Streams Assessment: Laboratory Methods Manual (EPA-841-B-07-010)(EPA, 2009d).

Flow Measurements

Flow rates will be measured and recorded in the logbook at predetermined locations using USGS gauges, cutthroat flumes, or flow meters. Method selection will be dependent on flow conditions and site access. Flow measurements will be taken concurrently with sampling. Flow measurements will be taken as close as possible to the sampling locations, though may be adjusted based on site access. Flow measurement device SOPs are listed in Worksheet 21.

Sampling Logistics and Contingencies

- Site Location and Weather Considerations
  - Access to the property will be obtained by the EPA. START must have consent from all applicable property owners (on property and off-property) prior to the field sampling event.
  - If weather delays are encountered, START will work with the OSC to reschedule sampling.
- Sample Information Importance and Data Variability
  - The purpose of this sampling is outlined in SAP Worksheet 11.
  - Contaminants or other important sample considerations: Flow measurements should be collected concurrently with the surface water sampling in order to allow use of the data for loading calculations.
  - Data Variability: Data variability should be identifiable and minimized by documenting the locations and material types of sampling and field screening targets.
- Potential Sampling Problems and Corrective Action
  - In the event of equipment malfunctions, START will obtain a backup/replacement unit from the EPA Region 8 warehouse or private equipment supply company if unavailable from the warehouse.
  - Areas deemed unsafe will not be entered.

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References

EPA, 2009a. *National Rivers and Streams Assessment: Field Operations Manual.* Office of Water, Office and Office of Environmental Information. EPA-841-B-07-009. April 2009.

EPA, 2009b. *National Rivers and Streams Assessment: Laboratory Methods Manual.* Office of Water, Office and Office of Environmental Information. EPA-841-B-07-010. Revision No.1. November 2009.

EPA, 2009c. *National Rivers and Streams Assessment: Site Evaluation Guidelines.* Office of Water, Office and Office of Environmental Information. EPA-841-B-07-008. February 2009.

EPA, 2009d. *National Rivers and Streams Assessment: Laboratory Methods Manual.* Office of Water, Office and Office of Environmental Information. EPA-841-B-07-010. November 2009.

EPA, 2010. *National Rivers and Streams Assessment: Quality Assurance Project Plan.* Office of Water Office and Office of Environmental Information. EPA 841-B-07-007. December 2010.

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Worksheet 18 — Sampling Locations and Methods

(UFP-QAPP Manual Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Sections 2.3.1 and 2.3.2)

The following locations have been identified as potential sampling locations. Actual locations sampled will vary based on site access and field conditions. Not necessarily all locations will be sampled.

Sampling Location / ID	Matrix	Latitude	Longitude	Type	Analyte/Analytical Group	Sampling SOP Reference[1]	Comments
CC48 (EPA) / 09358550 (USGS)	Surface Water	37.819984	-107.663275	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Cement Creek upstream of Silverton. Historic, long-term data record and release data available
	Sediment			Composite	Total Metals		
A68 (EPA) / 09358550 (USGS)	Surface Water	37.811202	-107.659167	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River above Cement Creek in Silverton. Reference condition for this release; historic, long-term data record and release data available
	Sediment			Composite	Total Metals		
M34 (EPA) / 09359010 (USGS)	Surface Water			Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Mineral Creek at USGS Gage upstream of Animas River
	Sediment			Composite	Total Metals		
A72 (EPA) / 82 (WQCD) /09359020 (USGS) / 3611 (RW)	Surface Water	37.79027	-107.667578	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River at gage below Silverton, downstream of confluence with Mineral Creek. Historic, long-term and release data record available

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Worksheet 18 — Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location / ID	Matrix	Latitude	Longitude	Type	Analyte/Analytical Group	Sampling SOP Reference[1]	Comments
	Sediment			Composite	Total Metals		
A73 (EPA) / 3442 (RW)	Surface Water	37.72215833	-107.65482778	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Not accessible in Fall. In canyon, train access only. Animas River upstream of Elk Creek. Historic, long-term data available; characterizes Animas before tributary influence.
	Sediment			Composite	Total Metals		
A75D (EPA) / 3438 (RW)	Surface Water	37.59793424	-107.77532681	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Not accessible in Fall. In canyon, train access only. Animas River upstream of Cascade Creek. Historic, long-term data record; characterizes Animas before tributary influence
	Sediment			Composite	Total Metals		
Bakers Bridge (EPA) / GKM02 (EPA) / 88 (RW)	Surface Water	37.454134	-107.801601	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River at Bakers Bridge (CO Hwy. 250). Historic, long-term and release data record available; pre-release water quality data available
	Sediment			Composite	Total Metals		
9426 (WQCD) / 89 (RW)	Surface Water	37.38506	-107.83686	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River near Trimble at CO Hwy 252 Bridge. Historic, long-term data record available; midway between Bakers Bridge and Durango
	Sediment			Composite	Total Metals		
	Biota			CO Method	Macroinvertebrates		

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Worksheet 18 — Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location / ID	Matrix	Latitude	Longitude	Type	Analyte/Analytical Group	Sampling SOP Reference[1]	Comments
Oxbow Park	Sediment	TBD	TBD	Composite	Total Metals		Historic/baseline data extremely limited
32nd St. Bridge (EPA) / 3577 (RW) / 3717591075 20601 (USGS)	Surface Water	37.299991	-107.868199	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River in Durango at 32nd St. Bridge. Historic, long-term and release data record available.
	Sediment			Composite	Total Metals		
Animas – Rotary Park (EPA) / 91 (RW) / 09361500 (USGS)	Surface Water	37.280718	-107.876927	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River at Rotary Park in Durango. Historic, long-term and release data record available.
	Sediment			Composite	Total Metals		
GKM05 (EPA)	Surface Water	37.268704	-107.885857	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River, south end of Durango near intersection of 160 and 550 above confluence with Lightner Creek. Release response site; unclear if long-term data available.
	Sediment			Composite	Total Metals		
	Biota			CO Method	Macroinvertebrates		

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Worksheet 18 — Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location / ID	Matrix	Latitude	Longitude	Type	Analyte/Analytical Group	Sampling SOP Reference[1]	Comments
GKM01 (EPA) / AR19-3 (SUIT) / Purple Cliffs (EPA) / 3713191075 15001 (USGS) / 3430 (RW) / 92 (RW) / NAR1 (SUIT)	Surface Water	37.221542	-107.859455	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River at Southern Ute Reservation boundary. Release response site; at CO/S. Ute Reservation border.
	Sediment			Composite	Total Metals		
AR 7-2 (SUIT) / NAR4 (SUIT)	Surface Water	37.084992	-107.878383	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River above confluence with Florida River. Historic data available.
	Sediment			Composite	Total Metals		
	Biota			CO Method	Macroinvertebrates		
AR2-7 / NAR 6 (SUIT)	Surface Water	37.024806	-107.8738	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River on Southern Ute Reservation just downstream of Heaven on Earth Road. Long-term data available, pre-release data available.
	Sediment			Composite	Total Metals		
	Biota			CO Method	Macroinvertebrates		

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Worksheet 18 — Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location / ID	Matrix	Latitude	Longitude	Type	Analyte/Analytical Group	Sampling SOP Reference[1]	Comments
ADW-022 (EPA) / 09364010	Surface Water	36.920559	-107.909909	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River at the Aztec Domestic Water System Intake. Pre-release data available.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		
ADW-021 (EPA) / 09364010 (USGS)	Surface Water	36.870511	-107.964815	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River at the Farmers Irrigation District Diversion Ditch
	Sediment			Composite	Total Metals		
ADW-010 (EPA) / 09364010 (USGS / 28.1 (NM) / 27.8 (NM)	Surface Water	36.837463	-107.991684	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River, mid-way between Southern Ute boundary and confluence with San Juan River. Pre-release data available.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		
FW-012 (EPA) / 09364500 (USGS)	Surface Water	36.783635	-108.102111	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River at Penney Lane Diversion Ditch
	Sediment			Composite	Total Metals		

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Worksheet 18 — Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location / ID	Matrix	Latitude	Longitude	Type	Analyte/Analytical Group	Sampling SOP Reference[1]	Comments
FW-040 (EPA)	Surface Water	36.783635	-108.102111	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		Animas River at confluence with San Juan River. USGS historic data available.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		
SJAR	Surface Water	TBD	TBD	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River above confluence with Animas River.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		
LVW-020	Surface Water	36.73074	-108.25033	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River downstream of Diversion Rubble Dam
	Sediment			Composite	Total Metals		
SJLP (EPA)	Surface Water	36.73588701	-108.2539868	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River below confluence with Animas River. Pre-release data available.
	Sediment			Composite	Total Metals		

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Worksheet 18 — Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location / ID	Matrix	Latitude	Longitude	Type	Analyte/Analytical Group	Sampling SOP Reference[1]	Comments
	Biota			NRSA Method	Macroinvertebrates		
SJFP (EPA) / NMRM-1005 (EPA) / 09367540 (USGS)	Surface Water	36.74815602	-108.4120157	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River near Farmington, NM. Pre-release data available; historic data (National Rivers and Streams Monitoring Assessment) available.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		
SJSR (EPA) / 09368000 (USGS)	Surface Water	36.78162422	-108.6927838	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River near Shiprock, NM. Pre-release data available.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		
SJ4C (EPA) / 09371010 (USGS / 4954000 (UT)	Surface Water	37.000777	-109.029577	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River just north of Four Corners on Ute Mountain Ute Reservation. Pre-release data available.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		

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Worksheet 18 — Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location / ID	Matrix	Latitude	Longitude	Type	Analyte/Analytical Group	Sampling SOP Reference[1]	Comments
SJMC (EPA) / 4953990	Surface Water	37.258226	-109.310604	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River near the confluence of McElmo Creek. Historic data (National River and Streams Monitoring Assessment) available; pre-release data available.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		
SJBB EPA) / UTRM-1009 (EPA) / 4953250 (USGS)	Surface Water	37.257527	-109.618941	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River at Bluff, UT. Historic data available (National Rivers and Streams Monitoring Assessment and State of Utah); pre-release and response data available.
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		
SJCH (EPA)	Surface Water	37.293347	-110.399285	Grab	Dissolved Metals, Total Metals, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Hardness, Alkalinity, Total Suspended Solids (TSS)		San Juan River at Clay Hills site
	Sediment			Composite	Total Metals		
	Biota			NRSA Method	Macroinvertebrates		

[1] Sampling SOPs references are provided in Worksheet 21.

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Worksheet 19 & 30 — Sample Containers, Preservation, and Hold Times

(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

All analyses will be conducted by a CLP laboratory, the Region 8 CRL, or a WESTON-subcontracted laboratory.

Laboratory (Name, sample receipt address, POC, e-mail, and phone numbers): TestAmerica
List Any Required Accreditations/Certifications: TBD
Back-up Laboratory: TBD
Sample Delivery Method: FedEx

Matrix	Analyte/ Analyte Group	Method/ SOP[1]	Container(s) (number, size & type per sample)[2]	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Sediment	Total Metals (including mercury)	200.7/200.8/245.1	One 4 ounce glass jar	Store @ < 4°C	180 days	40 days	TBD
Water	Total Metals (including mercury)	200.7/200.8/245.1	One 1-250 mL polyethylene bottle	HNO_3 to pH < 2 and store @ < 4°C	28 days for mercury, 180 days for all other metals	40 days	TBD
	Dissolved Metals (including mercury)	200.7/200.8/245.1	One 1-250 mL polyethylene bottle	Field Filtered: HNO_3 to pH < 2 and store @ < 4°C If not field filtered, no preservative	28 days for mercury, 180 days for all other metals	40 days	TBD
	Dissolved Organic Carbon	415.2	Three 3-40 mL amber VOA vials	Field Filtered: H_2SO_4 to pH < 2 and store @ < 4°C If not field filtered, no preservative	N/A	28 days	TBD
	Total Organic Carbon	415.1	Three 3-40 mL amber VOA vials	HCl to pH < 2 and store @ < 4°C	N/A	28 days	TBD

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Matrix	Analyte/ Analyte Group	Method/ SOP[1]	Container(s) (number, size & type per sample)[2]	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
	Hardness	SM 2340B	One 1-250 mL polyethylene bottle	HNO_3 to pH < 2 and store @ < 4°C	180 days	40 days	TBD
	Alkalinity	EPA 310.2	One 1-250 mL polyethylene bottle	Store @ < 4°C	none	14 days	TBD
	Total Suspended Solids	EPA 160.2	One 1-250 mL polyethylene bottle	Store @ < 4°C	none	7 days	TBD
Biota	Macroinvertebrates	CDPHE Policy 10-1; EPA NRSA	1 liter polyethylene bottle	95th Ethanol	none	NA – refresh ethanol monthly	TBD

[1] Refer to the Analytical SOP References table (Worksheet 23).

[2] The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory MS/MSD sample analysis.

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Worksheet 20 — Field Quality Control Sample Summary

(UFP-QAPP Manual Sections 3.1.1 and 3.1.2.)
(EPA 2106-G-05 Section 2.3.5)

Matrix	Analyte/Analytical Group	No. of Field Samples[1]	No. of Field Duplicates	No. of MS/MSD	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	No. of Other	Total No. of Samples to Laboratory
Surface water	Total Metals , Dissolved Metals, Dissolved Organic Carbon, Total Organic Carbon, Hardness	TBD	1 per 10	1 per 20 or 1 per day	1 per 20 or 1 per day	1 per 20 if using non-disposable equipment	0	0	TBD
Sediment	Total Metals	TBD	1 per 10	1 per 20 or 1 per day	1 per 20 or 1 per day	1 per 20 if using non-disposable equipment	0	0	TBD
Biota	Macroinvertebrate	TBD	1 per 10	NA	Na	NA	0	0	TBD

[1] Samples that are collected at different depths at the same location, and analyzed separately, will be counted as separate field samples. Even if they are taken from the same container as the parent field sample, MS/MSDs are counted separately, because they are analyzed separately. If composite samples or incremental samples are collected, only the sample that will be analyzed will be included; subsamples and increments will not be listed separately.

[2] Total number of samples to the laboratory does not include MS/MSD samples.

Note: The number and types of QC samples will be based on project-specific DQOs and this worksheet will be adapted, as necessary, to accommodate project-specific requirements. Project-specific QC samples may include field duplicate, field blank, equipment blank, trip blank, field split, MS/MSD, and PT samples and will be collected in accordance with the frequencies recorded on QAPP Worksheet 12. Quality Assurance Assessment and Corrective Actions are found in QAPP Worksheet #28.

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Worksheet 21 — Field SOPs

(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)

SOPs may include, but are not limited to, those identified in the table below.

SOP Number or Reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP Option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
2006	Sampling Equipment Decontamination, 6/2011	U.S. EPA, ERT		N	
2012	Soil Sampling, 6/2011	U.S. EPA, ERT		N	
2013	Surface Water Sampling, 6/2011	U.S. EPA, ERT		N	
2016	Sediment Sampling, 6/2011	U.S. EPA, ERT		N	
2049	Investigation-Derived Waste (IDW) Management, 6/2011	U.S. EPA, ERT		N	
G-12	Specifications and Guidance for Contaminant-Free Sample Containers, 12/1992	U.S. EPA, Office of Solid Waste and Emergency Response		N	
2001	General Field Sampling Guidelines, 6/2011	U.S. EPA, ERT		N	
CDPHE 2010	Standard Operating Procedures for the Collection of Water Samples, 2010 https://www.colorado.gov/pacific/sites/default/files/WQ_nonpoint_source-SOP-Collection-of-Water-Chemistry-Samples-050110.pdf	CDPHE		N	
WQCDSOP-001	Benthic Macroinvertebrate Sampling Protocols, 2010.	CDPHE		N	
N/A	Teledyne Workhorse Monitor ADCP	Teledyne RD Instruments	User Manual	N	
FLDM-722	Measuring Stream Flow with the Marsh-McBirney Flo Mate Model 2000, 8/10/11	U.S.EPA. R8 Lab		N	
FLD-08.00	FlowTracker Operation	ESAT		N	
EPA-841-B-07-009	National Rivers and Streams Assessment Field Operations Manual	EPA		N	
Policy Statement 10-1	Colorado Department of Public Health and Environment Policy 10-1 and SOPs	CDPHE		N	

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START will review existing information and may conduct sampling for removal/emergency response activities. Environmental samples will be collected for analysis at the EPA Region 8 CRL, ESAT laboratory, or by subcontracted laboratories.

Inclusive of the U.S EPA Region 8 Removal and Emergency Response Program, START may conduct a wetland determination on a site-specific basis in accordance with the methods described in the *Corps of Engineers Wetlands Delineation Manual (USACE 1987,* http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/reg_supp.aspx*)*, regional supplemental guidance, and subsequent clarification memoranda. The wetland determination is based on a three-parameter approach that requires evidence of the following wetland indicators: dominant hydrophytic vegetation, hydric soil characteristics, and the presence of wetland hydrology. An area must meet all three wetland indicator criteria (except where noted in the USACE 1987 Supplemental Manuals) to be considered a jurisdictional wetland.

During sampling activities, IDW may be generated. IDW may consist of decontamination fluids, purge/development water, excess sampled media (e.g., soil, sediment, water, etc.), disposable sampling supplies, and PPE (e.g., Tyvek/Saranex coveralls, gloves, booties, etc.). Handling of IDW will be performed according with SOP 2049 as listed above as well as procedures described in *Management of Investigation Derived Wastes during Site Inspections (May 1991*). Waste disposal for IDW will be dependent upon classification of the waste as either RCRA hazardous or RCRA nonhazardous waste.

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Worksheet 22 — Field Equipment Calibration, Maintenance, Testing, and Inspection

(UFP-QAPP Manual Section 3.1.2.4)
(EPA 2106-G-05 Section 2.3.6)

START field personnel are responsible for the calibration of EPA field equipment and field equipment provided by subcontractors. Documented and approved procedures will be used for calibrating measuring and testing equipment. Widely accepted procedures, such as those published by U.S. EPA and ASTM, or procedures provided by manufacturers in equipment manuals will be adopted. Items may include, but are not limited to those identified in the table below.

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title or Position of Responsible Person	Verification	SOP Reference[1]
Horiba U-53/YSI® 600XLM Water Quality Meters	Calibrate probes with standards per instrument instruction manual	Check batteries, clean probes, store in manufacturer recommended solution	Calibration check	Visually inspect for external damage to probe(s)	Refer to instrument SOP	Refer to instrument SOP	Refer to instrument SOP	Field personnel	WAM/COR	G-13/G-14
Sampling Tools (Disposable Scoops)	NA	NA	NA	Visually inspect for obvious defects or broken parts	Prior to use	NA	Replace	Field personnel	WAM/COR	NA
Disposable, inert sample mixing containers	NA	NA	NA	Visually inspect for cleanliness	Prior to use	NA	Replace	Field personnel	WAM/COR	NA
Metal sampling equipment as necessary (trowels)	NA	Clean prior and after each use	NA	Visually inspect for cleanliness	Prior to use	Should be covered from previous decontamination procedure	Perform decontamination procedure again as needed	Field personnel	NA	Metal sampling equipment as necessary (trowels)
Workhorse ADCP	NA	NA	NA	Visually inspect for obvious defects or broken parts	Prior to use	NA	Replace	Field personnel	WAM/COR	Teledyne RD Instruments
Marsh-McBirney Flo-Mate Model 2000	NA	NA	NA	Visually inspect for obvious defects or broken parts	Prior to use	NA	Replace	Field personnel	WAM/COR	EPA R8 Lab, FLDM-722

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Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title or Position of Responsible Person	Verification	SOP Reference[1]
FlowTracker	NA	NA	NA	Visually inspect for obvious defects or broken parts	Prior to use	NA	Replace	Field personnel	WAM/COR	ESAT FLD-08.00

[1] Refer to Field SOPs (Worksheet 21) and Analytical SOPs (Worksheet 23).

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Worksheet 23 — Analytical SOPs

(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

Items may include, but are not limited to those identified in the table below.

Lab SOP Number[1]	Title, Revision Date, and/or Number and URL (if available)	Screening or Definitive Data	Matrix/Analytical Group	SOP Option or Equipment Type	Modified for Project? (Y/N)
TBD	METHOD 200.7 DETERMINATION OF METALS AND TRACE ELEMENTS IN WATER AND WASTES BY INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROMETRY, 1994, http://water.epa.gov/scitech/methods/cwa/bioindicators/upload/2007_07_10_methods_method_200_7.pdf	Definitive	Water/Soil	ICP-AES	TBD
TBD	METHOD 200.8 DETERMINATION OF TRACE ELEMENTS IN WATERS AND WASTES BY INDUCTIVELY COUPLED PLASMA - MASS SPECTROMETRY, 1994, http://water.epa.gov/scitech/methods/cwa/bioindicators/upload/2007_07_10_methods_method_200_8.pdf	Definitive	Water/Soil	ICP-MS	TBD
TBD	METHOD 245.1 Mercury (Manual Cold Vapor Technique) http://www.bucksci.com/catalogs/245_1.pdf	Definitive	Water/Soil	CVAA	TBD
TBD	METHOD 415.1 TOTAL ORGANIC CARBON IN WATER http://www2.epa.gov/sites/production/files/2015-06/documents/415_1dqi.pdf	Definitive	Water	Combustion or Oxididation	TBD
TBD	METHOD 415.2 TOTAL ORGANIC CARBON IN WATER http://www2.epa.gov/sites/production/files/2015-06/documents/415_1dqi.pdf	Definitive	Water	UV Promoted, Persulfate Oxidation	TBD
TBD	METHOD SM 2340B HARDNESS https://www.nemi.gov/methods/method_summary/4679/	Definitive	Water	Titration	TBD

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Worksheet 23 — Analytical SOPs (Continued)

(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

Lab SOP Number[1]	Title, Revision Date, and/or Number and URL (if available)	Screening or Definitive Data	Matrix/Analytical Group	SOP Option or Equipment Type	Modified for Project? (Y/N)
TBD	METHOD EPA 160.2 Total Suspended Solids/Residue, Non-Filterable (Gravimetric, Dried at 103-105° C)	Definitive	Water	Gravimetric	N
TBD	EPA 310.2 Alkalinity Colorimeteric, Automated	Definitive	Water	Colorimeteric	N
TBD	METHOD SM 4500H+B pH Value in Water by Potentiometry Using a Standard Hydrogen Electrode. http://standardmethods.org/	Definitive	Water	pH Meter	TBD
SOM01.2	U.S. EPA CLP Statement of Work for Organic Analysis, SOM01.1, 5/2005, http://www.epa.gov/superfund/programs/clp/download/som/som11a-c.pdf MODIFICATIONS UPDATING SOM01.1 TO SOM01.2, 4/2007, http://www.epa.gov/superfund/programs/clp/download/som/som11tosom12mods.pdf	Definitive	Soil, sediment, debris, water, aquatic animal tissue/VOCs, SVOCs, Pesticides, Aroclors	Analyte specific	TBD
ISM01.3	U.S. EPA CLP Statement of Work for Inorganic Analysis, ISM01.2, 1/2010, http://www.epa.gov/superfund/programs/clp/download/ism/ism12a-c.pdf MODIFICATIONS UPDATING ISM01.2 TO ISM01.3, http://www.epa.gov/superfund/programs/clp/download/ism/ism12toism13mods.pdf	Definitive	Soil, sediment, debris, water, aquatic animal tissue/Metals and cyanide	Analyte specific	TBD
EPA-841-B-07-010	National Rivers and Streams Assessment: Laboratory Methods Manual	Definitive	Biota	Taxa Identification and Quantification	TBD

[1] Lab SOP numbers are lab-specific and will be identified once laboratory is selected.

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Worksheet 24 — Analytical Instrument Calibration

(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

As stated in Worksheet 22, START field personnel are responsible for the calibration of EPA and sub-contractor provided analytical field equipment. Documented and approved procedures will be used for calibrating measuring and testing equipment. Widely accepted procedures, such as those published by U.S. EPA and ASTM, or procedures provided by manufacturers in equipment manuals will be adopted.

The responsibility for the calibration of laboratory equipment rests with the selected laboratories. Each type of instrumentation and each U.S. EPA-approved method have specific requirements for the calibration procedures, depending on the analytes of interest and the sample medium. The calibration procedures and frequencies of the equipment used to perform the analyses will be in accordance with requirements established by the U.S. EPA. The laboratory QA manager will be responsible for ensuring that the laboratory instrumentation is maintained in accordance with specifications. Individual laboratory SOPs will be followed for corrective actions and preventative maintenance frequencies. Laboratory quality control, calibration procedures, corrective action procedures, and instrument preventative maintenance will be included in an addendum to this QAPP once the laboratories have been selected for each of the TBA sites. Items may include, but are not limited to those identified in the table below.

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
CVAA	200.7/200.8/245.1	Daily initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	R^2 ∟0.995 for linear regression	Correct problem then repeat initial calibration. If calibration fails again, re-digest the entire digestion batch.	Lab Manager/ Analyst	200.7/200.8/245.1

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Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-AES	200.7/200.8/245.1	Calibration and initial calibration verification after instrument set up, then daily; continuing calibration verifications. Upper range within 10%. New upper range limits should be determined whenever a significant change in instrument response or every six months. Low-level continuing calibration verification (LLCCV) standard with 30%.	Initial and continuing calibration verification within ± 10% of upper range true values and ± 30% LLCCV true values.	Inspect system; correct problem; re-run calibration and affected samples	Lab Manager/ Analyst	200.7/200.8/245.1
ICP/ ICP-MS	200.7/200.8/245.1	Calibration and initial calibration verification after instrument set up, then daily; continuing calibration verification 10% or every 2 hours, whichever is more frequent	Calibration r2 >0.995; initial and continuing calibration verification within ± 20% of true values	Inspect system; correct problem; re-run calibration and affected samples	Lab Manager/ Analyst	200.7/200.8/245.1

[1] Refer to the Analytical SOPs table (Worksheet 23).

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Worksheet 25 — Analytical Instrument and Equipment Maintenance, Testing, and Inspection

(UFP-QAPP Manual Section 3.2.3)
(EPA 2106-G-05 Section 2.3.6)

All laboratories conducting analyses of samples collected under the contract are required to have a preventative maintenance program covering testing, inspection, and maintenance procedures and schedule for each measurement system and required support activity. The basic requirements and components of such a program include the following:

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Title/ Position Responsible for CA	SOP Reference[1]
CVAA	Replace disposables, flush lines, check lamp current and gas flow	Sensitivity check	Instrument performance and sensitivity	Daily or as needed	CCV pass criteria	Recalibrate	Analyst	200.7/200.8/245.1
ICP-AES	Replace disposable, flush lines, and clean autosampler	Analytical standards	Instrument performance and sensitivity	Daily or as needed	CCV pass criteria	Recalibrate	Analyst	200.7/200.8/245.1
ICP/ICP-MS	Replace pump windings and gas tanks, check standard and sample flow	Monitor instrument standard (ISTD) counts for variation	Instrument performance and sensitivity	As needed	Monitor ISTD counts for variation	Replace windings, recalibrate and reanalyze	Analyst	200.7/200.8/245.1

[1] Refer to the Analytical SOPs table (Worksheet 23). A laboratory-specific QA Manual may be referenced on a project-specific basis and will be identified in the site specific SAP, and/or QAPP.

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Worksheet 26 & 27 — Sample Handling, Custody, and Disposal

(UFP-QAPP Manual Section 3.3)
(EPA 2106-G-05 Manual Section 2.3.3)

Sampling Organization: WESTON
Laboratory: Project-Specific - TBD
Method of sample delivery (shipper/carrier): Project-Specific - TBD
Number of days from reporting until sample disposal: Project-Specific - TBD

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample Labeling	Field Personnel	SOP G-1 & G-3
Chain-of-Custody Form Completion	Field Personnel	SOP G-8
Sample Packaging	Field Personnel	SOP G-9
Shipping Coordination	Field Personnel	SOP G-9
Sample Receipt, Inspection, & Log-in	Laboratory Sample Custodian	TBD – Per Laboratory SOP
Sample Custody and Storage	Laboratory Sample Custodian /Laboratory Analytical Personnel	TBD – Per Laboratory SOP
Sample Disposal	Field Personnel/Laboratory Sample Custodian /Laboratory Analytical Personnel	SOP G-1 & G-3/ TBD – Per Laboratory SOP

Supplies and consumables can be received at a START office, U.S. EPA Warehouse or at a site. When supplies are received at a START office or U.S. EPA Warehouse, the PM or PTL will sort the supplies according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before the supplies are accepted for use on a project. If the supplies do not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order. The item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar to those described above. Upon receipt, items will be inspected by the START PM or PTL against the acceptance criteria. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

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Worksheet 28 — Analytical Quality Control and Corrective Action

(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

The following information is laboratory-specific. The following are typical examples for Organics and Inorganics for all media.

Matrix: All
Analytical Group: All
Analytical Method/SOP: All/All

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits[1]	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
Method Blank	1/Batch (20 samples)	No Target Compounds >1/2 RL; no common lab contaminants >RL.	If sufficient sample is available, reanalyze samples. Qualify data as needed. Report results if sample results >10x blank result or sample results non-detect (ND).	Analyst / Section Supervisor	No Target Compounds >1/2 RL; no common lab contaminants >RL.
LCS	1/Batch (20 samples)	Analyte-specific	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst / Section Supervisor	Laboratory % Recovery Control Limits
MS/MSD	1/Batch (20 samples)	Analyte-specific	Determine root cause; flag MS/MSD data; discuss in narrative.	Analyst / Section Supervisor	Laboratory % Recovery / RPD Control Limits
Surrogates	Every sample	Refer to the laboratory-specific QA Manual and/or the U.S. EPA National Functional Guidelines for Organic Data Review Table Surrogate control limits	Check calculations and instrument performance; recalculate, reanalyze.	Analyst / Section Supervisor	Laboratory % Recovery Control Limits
Dilution Test	One per preparatory batch	1:5 dilution must agree within ±10% of the original determination	Perform post digestion spike addition	Analyst / Section Supervisor	Only applicable for samples with concentrations > 50x Limit of Detection (LOD)

Field and laboratory QC samples and measurements will be used to verify that analytical data meet project-specific MPC, which are based on Project Quality Objectives (PQOs)/DQOs. Field QC samples and measurements and laboratory QC samples will be used to assess how they influence data quality. The project-specific SAP, and/or QAPP will include the information presented in the table above for each sampling technique, analytical method/SOP, matrix, and analytical group. See Worksheet 12 and 20 for descriptions of QC samples, DQIs, and MPC.

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Worksheet 29 — Project Documents and Records

(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

All records will be generated and verified by START personnel only, stored electronically on the START server and backed up daily. All hard and electronic copies of finalized documents and technical project documents (including but not limited to the QAPP, HASP, etc.) will be retained in accordance with Section H.20 of Contract No.: EP-S8-13-01. Other project-related files, such as contract documents, employee benefits, and other information will be retained in accordance with WESTON Policies and Procedures.

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Field Logbook or Data Collection Sheets	PTL/Field Scientist	Delegated QA Manager	Project File
Chain-of-Custody (COC) Forms	PTL/Field Scientist	Delegated QA Manager	Project File
Custody Seals	PTL/Field Scientist	Delegated QA Manager	Project File
Air Bills	PTL/Field Scientist	Delegated QA Manager	Project File
Daily QC Reports	PTL	Delegated QA Manager	Project File
Deviations	PTL/Field Scientist	Delegated QA Manager	Project File
Corrective Action Reports	Delegated QA Manager	PM	Project File
Correspondence	PTL	Delegated QA Manager	Project File
Field Sample Results/Measurements	PTL/Field Scientist	Delegated QA Manager	Project File
Tailgate Safety Meeting Items	PTL/Field Safety Officer	Delegated QA Manager	Project File

Project Assessments			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Field Analysis Audit Checklist	Delegated QA Manager	PM	Project File
Fixed Laboratory Audit Checklist	Delegated QA Manager	PM	Project File
Data Verification Checklists	Delegated QA Manager	PM	Project File
Data Validation Report	Delegated QA Manager	PM	Project File
Data Usability Assessment Report	Delegated QA Manager	PM	Project File
Corrective Action Reports	Delegated QA Manager	PM	Project File
Correspondence	Delegated QA Manager	PM	Project File

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Worksheet 29 — Project Documents and Records (Continued)

(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

Laboratory Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Sample Receipt, Custody, and Checklist	Laboratory Sample Receiving	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Equipment Calibration Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Standard Traceability Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Sample Prep Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Run Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Equipment Maintenance, Testing, and Inspection Logs	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Corrective Action Reports	Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Laboratory Analytical Results	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Laboratory QC Samples, Standards, and Checks	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Instrument Results (raw data) for Primary Samples, Standards, QC Checks, and QC Samples	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory and Project File
Sample Disposal Records	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory and Project File

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Worksheet 29 — Project Documents and Records (Continued)

(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

Laboratory Data Deliverables[1]						
Record	**VOCs**	**SVOCs**	**PCBs**	**Pesticides**	**Metals**	**Other**
Narrative						
COC						
Summary Results						
QC Results						
Chromatograms						
Tentatively Identified Compounds						

[1] TheLaboratory Data Deliverables table is designed to be a checklist for use in supporting data completeness. The records and analytical groups in this table are not all inclusive of those that may be used on a specific project and should be modified and utilized by the Delegated QA Manager as applicable.

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Worksheet 31, 32 & 33 — Assessments and Corrective Action

(UFP-QAPP Manual Sections 4.1.1 and 4.1.2)
(EPA 2106-G-05 Section 2.4 and 2.5.5)

All reports will be prepared by WESTON and distributed to the following to include but not be limited to the WESTON PM, Program Manager and Delegated QA Manager, and the U.S. EPA COR, WAM, and DAO as applicable.

Assessment Type	Responsible Party & Organization	Number/ Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Laboratory TSA[2]	DAO/WAM/COR EPA Laboratory QA Manager TBD Delegated QA Manager WESTON	CLP, CRL, and certified sub-contract laboratories are routinely audited by accrediting authorities. The laboratory QA manager and/or WESTON Delegated QA Manager will perform audits on a project-specific basis as needed	TBD	Analytical TSA Memorandum and Checklist	TBD
Management Review	DAO/WAM/COR EPA Delegated QA Manager and PM WESTON	1/year	TBD	QA Management Report	TBD
Corrective Action	DAO/WAM/COR EPA Delegated QA Manager and PM WESTON	TBD	TBD	Corrective Action Reports	TBD
Data Validation	Chemist WESTON	TBD	TBD	Data Validation Report	TBD
Contract Closeout	Program Manager WESTON	1	TBD	Contract Closeout Report	TBD

[1] Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

[2] Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

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Worksheet 34 — Data Verification and Validation Inputs

(UFP-QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

The following informationwill be used during data verification and validation. Inputs may include, but are not limited to those identified in the table below.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
5	Laboratory QA Manual	X	
6	Laboratory Certifications	X	
Field Records			
7	Field Logbooks	X	X
8	Equipment Calibration Records	X	X
9	COC Forms	X	X
10	Sampling Diagrams/Surveys	X	X
11	Drilling Logs	X	X
12	Geophysics Reports	X	X
13	Relevant Correspondence	X	X
14	Change Orders/Deviations	X	X
15	Field Audit Reports	X	X
16	Field Corrective Action Reports	X	X
17	Sample Location Verification (Worksheet 18)	X	X
Analytical Data Package			
18	Cover Sheet (laboratory identifying information)	X	X
19	Case Narrative	X	X
20	Internal Laboratory COC	X	X
21	Sample Receipt Records	X	X
22	Sample Chronology (i.e. dates and times of receipt, preparation, & analysis)	X	X
23	Communication Records	X	X
24	Project-specific PT Sample Results	X	X
25	LOD/LOQ Establishment and Verification	X	X
26	Standards Traceability	X	X
27	Instrument Calibration Records	X	X
28	Definition of Laboratory Qualifiers	X	X
29	Results Reporting Forms	X	X
30	QC Sample Results	X	X
31	Corrective Action Reports	X	X
32	Raw Data	X	X
33	Electronic Data Deliverable	X	X

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Worksheet 35 — Data Verification Procedures

(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

The following information may include, but are not limited to those identified in the table below.

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Approved QAPP	Programmatic and site-specific SAP, and/or QAPP, Contract	Verify completeness, correctness, and contractual compliance of all project QA/QC and data set against the methods, SOPs, and contract requirements conforms.	Tana Jones., START Mark Blanchard, START David Robinson, START TBD
Field SOPs	Programmatic and site-specific SAP, and/or QAPP, SOPs	Ensure that all field sampling SOPs were followed.	David Robinson., START
Analytical SOPs	Programmatic and site-specific SAP, and/or QAPP, SOPs	Ensure that all laboratory analytical SOPs were followed.	Tana Jones, PMP, START Laboratory PM, TBD
Field Logbook, Field Sheets, Sample Diagrams/ Surveys	Programmatic and site-specific SAP, and/or QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	David Robinson., START
Equipment Calibration Records	Programmatic and site-specific SAP, and/or QAPP, SOPs, field logbook	Ensure that all field analytical instrumentation SOPs and laboratory analytical SOPs for equipment calibration were followed.	Tana Jones, PMP, START Laboratory PM, TBD

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Worksheet 35 — Data Verification Procedures (Continued)

(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
COC Forms	Programmatic and site-specific SAP, and/or QAPP	Verify the completeness of COC records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Moira Pryhoda., START Laboratory PM, TBD
Relevant reports, and correspondence	Programmatic and site-specific SAP, and/or QAPP	Verify that reports are present and complete for each day of field activities. Verify that correspondence are documented and were reported in accordance with requirements.	Bryan Williams., START N
Laboratory Deliverable	Programmatic and site-specific SAP, and/or QAPP	Verify that the laboratory deliverable contains all records specified in the QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with COCs to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Jan Christner, P.E., START Moira Pryhoda, WESTON
Audit Reports, Corrective Action Reports	Programmatic and site-specific SAP, and/or QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	Tana Jones, START Moira Pryhoda, START Laboratory PM, TBD

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Worksheet 36 — Data Validation Procedures

(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Data Validator: START

Analytical Group/ Method	Data Deliverable Requirements	Analytical Specifications	MPC	Percent of Data Packages to be Validated	Percent of Raw Data Reviewed	Percent of Results to be Recalculated	Validation Procedure	Validation Code	Electronic Validation Program/ Version
Total and Dissolved Metals	Scribe Compatible EDD	QAPP Worksheet 28	Worksheets 11, 12, 19 & 30	10%	0%	0%	U.S. EPA Stage 2A	SV2aE	N/A

Validation will be performed on all laboratory analytical data unless a defined quantity or percentage of samples is identified by the U.S. EPA in the Technical Direction Document or during the project scoping meeting on a project-specific basis.. Project validation criteria as per QAPP Worksheets 12, 15, 19 & 30, 28, and 36, and cited EPA SW-846 methodology will be used. WESTON-contracted laboratory data packages will be verified and validated using a Stage 2A validation, as described in the EPA *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (January 2009) (Appendix J) unless otherwise specified by the U.S. EPA WAM/COR during the development of the DQOs. Validation Qualifiers will be applied using the following hierarchy: Region 8 UFP-QAPP for Removal Actions and Emergency Responses; the site-specific SAP, and/or QAPP; *EPA National Functional Guidelines for Organic Data Review* (Appendix K); *EPA National Functional Guidelines for Inorganic Data Review* (Appendix L); EPA Publication SW-846; and the laboratory-specific SOP. Methods for which no data validation guidelines exist will be validated following the guidance deemed most appropriate by the data validator.

The data validator will receive all laboratory packages and analytical results electronically. Additionally, the validator will be required to submit final validation reports via PDF format and must provide an annotated laboratory analytical result electronic data deliverable (EDD) with applicable data validation qualifiers (Appendix M) identified in the site-specific SAP, and/or QAPP, and/or result value modifications. The Delegated QA Manager will use EPA document *Using Qualified Data to Document an Observed Release and Observed Contamination* (July 1996) to aid in determining the use of qualified data to document all observed release and observed contamination by chemical analysis under U.S. EPA's HRS. Approved data will be released by the Delegated QA Manager for reporting.

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Worksheet 37 — Data Usability Assessment

(UFP-QAPP Manual Section 5.2.3 and Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Personnel (organization and position/title) responsible for participating in the data usability assessment may include, but not be limited to:

- START PM;
- START Delegated QA Manager;
- START Risk Assessor;
- START Chemist;
- START PTL;
- START Statistician.

Based on project-specific oversight responsibilities and analytical scopes, this data usability assessment worksheet outlines the approach that will be taken as the analytical scope expands on a project-specific basis. The following general steps will be followed to assure that the data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence:

- Step 1 – Review the project's objectives and sampling design;
- Step 2 – Review the data verification and data validation outputs;
- Step 3 – Verify the assumptions of the selected statistical method;
- Step 4 - Implement the statistical method;
- Step 5 – Document data usability and draw conclusions.

The data usability assessment is considered the final step in the data evaluation process; all data will be assessed for usability, regardless of the data evaluation/validation process implementation. Data usability goes beyond validation in that it evaluates the achievement of the DQOs based on the comparison of the project DQIs and individual study-specific work plans, with the obtained results. The results of the data usability assessment, and particularly any changes to the DQOs necessitated by the data not meeting usability criteria, will be reported in accordance with Worksheet 6.

Primarily, the assessment of the usability will follow procedures described in appropriate EPA guidance documents, particularly *Guidance for Data Usability in Risk Assessment* (Publication No. 9285.7-05FS, September 1992)(Appendix U), and will be conducted according to the process outlined below.

1. **Sampling and Analysis Activities Evaluation**: The first part of the data usability evaluation will include a review of the sampling and analysis activities in comparison to project-specific DQIs and study-specific work plans. Specific limitations to the data (i.e., results that are qualified as estimated [J/UJ], or rejected [R], will be determined and documented in the database).

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Worksheet 37 — Data Usability Assessment (Continued)

(UFP-QAPP Manual Section 5.2.3 and Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

2. **Achievement of DQIs**: The second part of data usability pertains to the achievement of the program-specific DQIs. Each investigator will compare the performance achieved for each data quality criterion against the expected and planned performance. In general, this comparison will follow from the DQIs used to define each DQO. This comparison is the most critical component of the assessment process. Any deviation from planned performance will be documented and evaluated to determine whether corrective action is advisable. Potential corrective actions will range from re-sampling and/or reanalysis of data, to qualification or exclusion of the data for use in the data interpretation. In the event that corrective action is not possible, the limitations, if any, of the data with regard to achieving the DQOs will be noted.

   In conjunction with the DQI achievement review, the investigators will need to make decisions for the use of qualified values, which are a consequence of the formalized evaluation/validation process. Data qualifiers will be applied to individual data results. Data usability decisions will be made based on the assessment of the usability of each of these results for the intended purpose. Evaluation will describe the uncertainty (bias, imprecision, etc.) of the qualified results. Cumulative QC exceedances from the DQIs may require technical judgment to determine the overall effect on the usability of the data. Decisions about usability of qualified data for use in risk assessment will be based on the EPA document mentioned, which allows for the use of estimated values. Finally, data users may choose to determine final data usability qualifiers as a result of this overall examination and decision process.

3. **Achievement of DQOs**: The final part in the data usability process concerns achievement of the DQOs. Once the data set has been assessed to be of known quality, data limitations have been documented, and overall result applicability/usability for its intended purpose has been determined, the final data assessment can be initiated by considering the answers to the following questions:

   - Are the data adequate to determine the extent to which hazardous substances have migrated or to what extent they were expected to migrate from potential hazardous substance source areas?
   - Do the data collected adequately characterize the nature and extent of potential hazardous substance source areas at the site?
   - Are the data statistically adequate to evaluate on a per chemical and per media basis?
   - Do the data collected allow assessment of hydrogeologic factors, which may influence contaminant migration/distribution?
   - Do laboratory reporting limits attain the applicable state and/or federal standards and/or screening levels?
   - Is the sample set sufficient to develop site-specific removal and disposal treatment methodologies?

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Worksheet 37 — Data Usability Assessment (Continued)

(UFP-QAPP Manual Section 5.2.3 and Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

- Have sufficient data been collected to evaluate how factors including physical characteristics of the site and climate and water table fluctuations affect contaminant fate and transport?
- Have sufficient data been collected to determine the toxicity, environmental fate, and other significant characteristics of each hazardous substance present?
- Is the data set sufficient to evaluate the potential extent and risk of future releases of hazardous substances, which may remain as residual contamination at the source facility?

Principal investigators, in conjunction with the project team, will formulate solutions if data gaps are found as a result of problems, biases, trends, etc., in the analytical data, or if conditions exist that were not anticipated in the development of the DQOs. It is particularly important that each data usability evaluation specifically address any limitations on the use of the data that may result from a failure to achieve the stipulated DQO.

If the project scope changes, the DQOs will be expanded. The DQOs will address the specific action limits and measurable performance criteria, in order to make appropriate decisions on the analytical data.

DQIs, such as precision, accuracy, completeness, representativeness, and comparability measurements, aid in the evaluation process and are discussed below.

Precision

The most commonly used estimates of precision are the RPD for cases in which only two measurements are available, and the percent RSD (%RSD) when three or more measurements are available. This is especially useful in normalizing environmental measurements to determine acceptability ranges for precision because it effectively corrects for the wide variability in sample analyte concentration indigenous to samples.

Precision is represented as the RPD between measurement of an analyte in duplicate samples or in duplicate spikes. RPD is defined as follows:

$$RPD = \frac{|C_1 - C_2|}{\frac{C_1 + C_2}{2}} \times 100$$

Where:

C_1 = First measurement value
C_2 = Second measurement value

For field measurements such as pH, where the absolute variation is more appropriate, precision is often reported as the absolute range (D) of duplicate measurements:

$$\%D = m1 - m2$$

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Worksheet 37 — Data Usability Assessment (Continued)

(UFP-QAPP Manual Section 5.2.3 and Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Where:
*m*1 = First measurement value
*m*2 = Second measurement value
The % RSD is calculated by the standard deviation of the analytical results of the replicate determinations relative to the average of those results for a given analyte. This method of precision measurement can be expressed by the formula:

$$\%\,RSD = \frac{\sqrt{\sum_{i=1}^{N}\left(\frac{RF_i - RF}{N-1}\right)}}{RF} \times 100$$

Where:
RF = Response factor
N = Number of measurements

Precision control limits for evaluation of sample results are established by the analysis of control samples. The control samples can be method blanks fortified with surrogates (e.g., for organics), or LCS purchased commercially or prepared at the laboratory. The LCS is typically identified as blank spikes (BS) for organic analyses. For multi-analyte methods, the LCS or BS may contain only a representative number of target analytes rather than the full list.

The RPD for duplicate investigative sample analysis provides a tool for evaluating how well the method performed for the respective matrix.

Accuracy/Bias

Accuracy control limits are established by the analysis of control samples, which are in water and/or solid/waste matrices. For organic analyses, the LCS may be a surrogate compound in the blank or a select number of target analytes in the blank spike. The LCS is subjected to all sample preparation steps. When available, a solid LCS may be analyzed to demonstrate control of the analysis for soil. The amount of each analyte recovered in an LCS analysis is recorded and entered into a database to generate statistical control limits. These empirical data are compared with available method reference criteria and available databases to establish control criteria.

The %R for spiked investigative sample analysis (e.g., matrix spike) provides a tool for evaluating how well the method worked for the respective matrix. These values are used to assess a reported result within the context of the project data quality objectives. For results that are outside control limits provided as requirements in the QAPP, corrective action appropriate to the project will be taken and the deviation will be noted in the case narrative accompanying the sample results. Percent recovery (%R) is defined as follows:

$$\%\,Recovery = \frac{(A_T - A_0)}{A_F} \times 100$$

Where:

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Worksheet 37 — Data Usability Assessment (Continued)

(UFP-QAPP Manual Section 5.2.3 and Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

A_T = Total amount recovered in fortified sample
A_0 = Amount recovered in unfortified sample
A_F = Amount added to sample

Accuracy for some procedures is evaluated as the degree of agreement between a new set of results and a historical database or a table of acceptable criteria for a given parameter. This is measured as percent difference (%D) from the reference value, and is primarily used by the laboratory as a means for documenting acceptability of continuing calibration.

The %D is calculated by expressing, as a percentage, the difference between the original value and new value relative to the original value. This method for precision measurement can be expressed by the formula:

$$\%D = \frac{C_1 - C_2}{C_1} \times 100$$

Where:
C_1 = Concentration of analyte in the initial aliquot of the sample.
C_2 = Concentration of analyte in replicate.

The laboratory will review the QC samples and surrogate recoveries for each analysis to ensure that the %R lies within the control limits listed in the UFP-QAPP. Otherwise, data will be flagged by the laboratory.

For field measurements such as pH, accuracy is often expressed in terms of bias (B) and is calculated as follows:

$$B = M - A$$

Where:
M = Measured value of Standard Reference Material (SRM)
A = Actual value of SRM

Sensitivity

Sensitivity is the ability of the analytical test method and/or instrumentation to differentiate between detector responses to varying concentrations of the target constituent. Methodology to establish sensitivity for a given analytical method or instrument includes examination of standardized blanks, instrument detection limit studies, and calibration of the QL. The findings of the usability of the data relative to sensitivity will be included in the report, including any limitations on the data set and/or individual analytical results.

The Precision, Accuracy, Representativeness, Completeness, Comparability and Sensitivity MPC are described in Worksheets 12, 15, and 28. The following steps will be performed:

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Worksheet 37 — Data Usability Assessment (Continued)

(UFP-QAPP Manual Section 5.2.3 and Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

- Evaluate if the project required quantitation limits listed in Worksheet 15 were achieved for non-detected site contaminants. If no detectable results were reported and data are acceptable for the verification and validation steps, then the data are usable.
- If detectable concentrations are reported and the verification and validation steps are acceptable, the data are usable.
- If verification and validation are not acceptable, the data are qualified, estimated (J, UJ) for minor QC deviations that do not affect the data usability, or rejected for major QC deviations affecting data usability. The impact of rejected data will be evaluated and re-sampling may be necessary. Use of estimated data will be discussed in the project report.
- For statistical comparisons and mathematical manipulations, non-detect values will be represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate will be used to represent the concentration at that sample location.

Statistical tests will be conducted to identify potential outliers. Potential outliers will be removed if a review of the field and laboratory documentation indicates that the results are true outliers.

Method sensitivity is typically evaluated in terms of the method detection limit (MDL) and is defined as follows for many measurements:

$$MDL = {}^{t}(n - 1, 1 - \alpha = 0.99)(s)$$

Where:

s = Standard deviation of the replicate analyses
${}^{t}(n - 1, 1 - \alpha = 0.99)$ = Student's t-value for a one-sided 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom
n = Number of measurements
α = Statistical significance level

Representativeness

Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that depends on proper design of the sampling program.

Data representativeness for this project is accomplished by implementing approved sampling procedures and analytical methods that are appropriate for the intended data uses, and which are established within the site-specific SAP, and/or QAPP.

Field personnel will be responsible for collecting and handling samples according to the procedures in this UFP-QAPP and the site-specific SAP, and/or QAPP so that samples are representative of field conditions. Errors in sample collection, packaging, preservation, or chain-of-custody procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

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Worksheet 37 — Data Usability Assessment (Continued)

(UFP-QAPP Manual Section 5.2.3 and Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another, whether it was generated by a single laboratory or during inter-laboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data. Sample collection and handling procedures will adhere to U.S. EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units, use standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

Completeness

Project-specific completeness goals account for all aspects of sample handling, from collection through data reporting. The level of completeness can be affected by loss or breakage of samples during transport, as well as external problems that prohibit collection of the sample. The following calculation is used for determining the percent complete:

$$\text{Completeness} = \frac{A}{B} \times 100$$

Where:

A = Actual number of measurements judged valid (the validity of a measurement result is determined by judging its suitability for its intended use)

B = Total number of measurements planned to achieve a specified level of confidence in decision making

The formula for sampling completeness is:

$$\text{Sampling Completeness} = \frac{\text{Number of locations sampled}}{\text{Number of planned sample locations}} \times 100$$

An example formula for analytical completeness is:

$$\text{Metals Analytical Completeness} = \frac{\text{Number of Usable Data Points}}{\text{Expected Number of Usable Data Points}} \times 100$$

The ability to meet or exceed completeness objectives is dependent on the nature of samples submitted for analysis.

Graphics

Graphic figures will be generated to depict sample locations, as needed. Also, if necessary, figures will be generated to represent contaminant concentrations at each sampling location. Each figure will contain a detailed legend.

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Worksheet 37 — Data Usability Assessment (Continued)

(UFP-QAPP Manual Section 5.2.3 and Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Reconciliation

PQOs will be examined to determine if the objective was met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of the major impacts observed from the data verification and validation, DQIs, and MPC assessments. Based on the results of these assessments, the quality of the data will be determined. Based on the quality determined, the usability of the data for each analysis will be determined. Based on the combined usability of the data from all analyses for an objective, it will be determined if the PQO was met and whether project action limits were exceeded. As part of the reconciliation of each objective, conclusions will be drawn, and any limitations on the usability of any of the data will be described.

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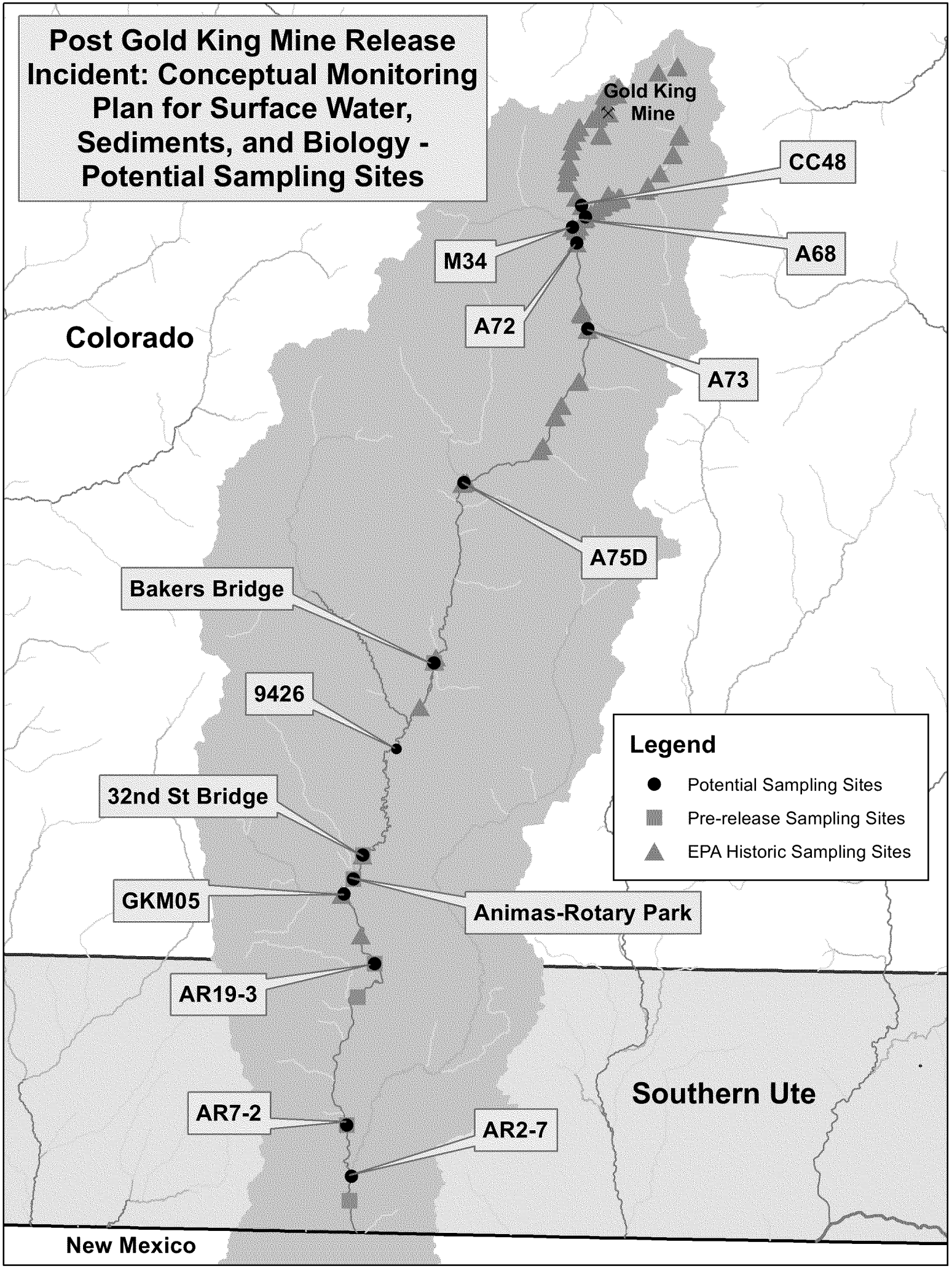
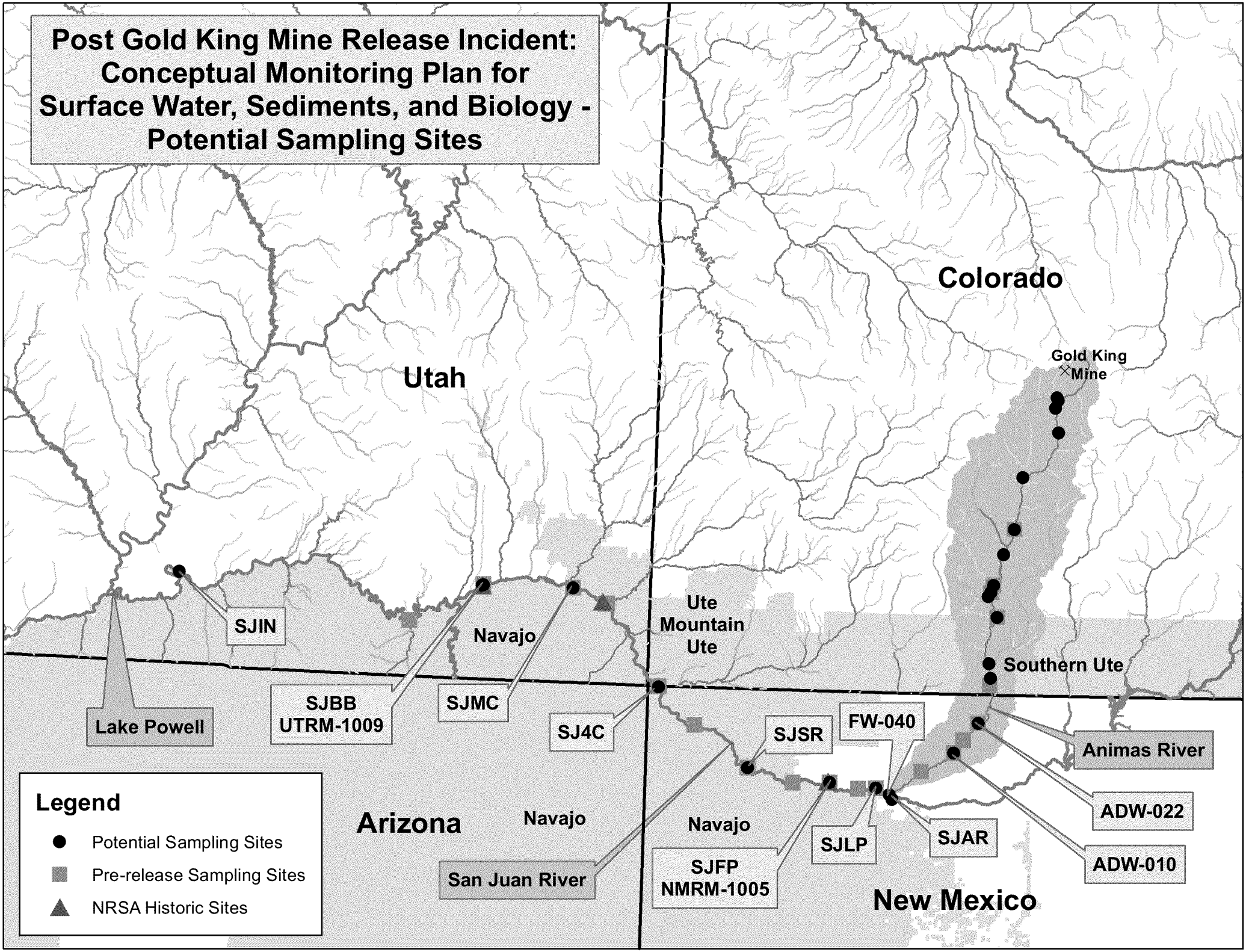
FIGURES


Post Gold King Mine Release Incident: Conceptual Monitoring Plan for Surface Water, Sediments, and Biology - Potential Sampling Sites
Gold King Mine
CC48
A68
M34
A72
A73
Colorado
A75D
Bakers Bridge
9426
32nd St Bridge
GKM05
Animas-Rotary Park
AR19-3
Southern Ute
AR7-2
AR2-7
New Mexico
Legend
Potential Sampling Sites
Pre-release Sampling Sites
EPA Historic Sampling Sites


Post Gold King Mine Release Incident: Conceptual Monitoring Plan for Surface Water, Sediments, and Biology - Potential Sampling Sites
Colorado
Utah
Gold King Mine
Navajo
Ute Mountain Ute
Southern Ute
SJIN
Lake Powell
SJBB UTRM-1009
SJMC
SJ4C
SJSR
FW-040
Animas River
ADW-022
SJAR
SJLP
ADW-010
SJFP NMRM-1005
San Juan River
Arizona
Navajo
Navajo
New Mexico
Legend
Potential Sampling Sites
Pre-release Sampling Sites
NRSA Historic Sites

APPENDIX A
EPA REGION 8 QA DOCUMENT REVIEW CROSSWALK

EPA REGION 8 QA DOCUMENT REVIEW CROSSWALK

QAPP/FSP/SAP for: *(check appropriate box)*		**Gold King Mine Long Term Monitoring**	**Regulatory Authority and/or Funding Mechanism**	**X**	**40 CFR 31 for Grants**
	GRANTEE	Region 8 START Contractor			**48 CFR Part 46 for Contracts**
X	**CONTRACTOR**				**Interagency Agreement**
	EPA				**EPA Administrative Order**
	Other				**EPA Program Funding**
					EPA Program Regulation
					EPA CIO 2105
Document Title *[Note: Title will be repeated in Header]*		SAP/QAPP for Gold King Mine Long Term Monitoring			
QAPP/FSP/SAP Preparer		Mark Blanchard/Moira Pryhoda			
Period of Performance (of QAPP/FSP/SAP)		1 year	**Date Submitted for Review**		10/9/2015
EPA Project Officer		Joyce Ackerman	**PO Phone #**		303-312-6822
EPA Project Manager		Steve Merritt	**PM Phone #**		303-312-6146
QA Program Reviewer or Approving Official		Steve Merritt	**Date of Review**		

Documents to Review:

1. QAPP written by Grantee or EPA must also include for review:
   Work Plan(WP) / Statement of Work (SOW) / Program Plan (PP) / Research Proposal (RP)

2. QAPP written by Contractor must also include for review:
   a) Copy of signed QARF for Task Order
   b) Copy of Task Order SOW
   c) Made available hard or electronic copy of approved QMP
   d) If QMP not approved, provide Contract SOW

3. For a Field Sampling Plan (FSP) or Sampling & Analyses Plan (SAP), the Project QAPP must also be provided.
   OR
   The FSP or SAP must be clearly identified as a stand-alone QA document and must contain all QAPP required elements (Project Management, Data Generation/Acquisition, Assessment and Oversight, and Data Validation and Usability).

Documents Submitted for QAPP Review:

1. QA Document(s) submitted for review:

QA Document	Document Date	Document Stand-alone	Document with QAPP
QAPP	10/9/2015	No	
FSP	NA	Yes / No	Yes / No
SAP	10/9/2015	No	Yes
SOP(s)	NA	Yes / No	Yes / No

2. WP/SOW/TO/PP/RP Date 10/9/15
WP/SOW/TO/RP Performance Period _____

3. QA document consistent with the:
WP/SOW/PP for grants? Yes / No
SOW/TO for contracts? **Yes** / No

4. QARF signed by R8 QAM Yes / No / NA

Funding Mechanism IA / **contract** / grant / NA

Amount _____

Summary of Comments *(highlight significant concerns/issues)*:

1. Comment #1
2. Comment #2
3. Comment #3
4. Comment #4

Element	Acceptable *Yes/No/NA*	Location	Comments
A. Project Management			
A1. Title and Approval Sheet			
a. Contains project title	Yes	Title Page and Introduction Worksheet 1 & 2	
b. Date and revision number line (for when needed)	Yes	Revison Log	
c. Indicates organizations name	Yes	Title Page	
d. Date and signature line for organizations project manager	Yes	Worksheets 1 & 2 Worksheets 1,2 4,7 & 8	
e. Date and signature line for organizations QA manager	Yes	Worksheets 1& 2	
f. Other date and signatures lines, as needed	Yes	Worksheets 1 & 2 Worksheets 4,7 & 8	
A2. Table of Contents			
a. Lists QA Project Plan information sections	Yes	Table of Contents, SAP List of Appendices	
b. Document control information indicated	Yes	Title Page and Worksheet 1 & 2 Worksheet 1 & 2	
A3. Distribution List			
Includes all individuals who are to receive a copy of the QA Project Plan and identifies their organization	Yes	Introduction Worksheet 3 & 5	
A4. Project/Task Organization			
a. Identifies key individuals involved in all major aspects of the project, including contractors	Yes	Worksheet 3 & 5	
b. Discusses their responsibilities	Yes	Worksheet 4, 7 & 8	
c. Project QA Manager position indicates independence from unit generating data	Yes	Worksheet 3 & 5	
d. Identifies individual responsible for maintaining the official, approved QA Project Plan	Yes	Introduction Worksheet 4, 7 & 8	
e. Organizational chart shows lines of authority and reporting responsibilities	Yes	Worksheet 3 & 5	
A5. Problem Definition/Background			
a. States decision(s) to be made, actions to be taken, or outcomes expected from the information to be obtained	Yes	Worksheet 9, 11	
b. Clearly explains the reason (site background or historical context) for initiating this project	Yes	Worksheet 10	
c. Identifies regulatory information, applicable criteria, action limits, etc. necessary to the project	Yes	Worksheets 10, 11, 15	
A6. Project/Task Description			
a. Summarizes work to be performed, for example, measurements to be made, data files to be obtained, etc., that support the projects goals	Yes	Worksheet 14 & 16, SAP Worksheet 17	

Element	Acceptable *Yes/No/NA*	Location	Comments
b. Provides work schedule indicating critical project points, e.g., start and completion dates for activities such as sampling, analysis, data or file reviews, and assessments	Yes	Worksheet 14 & 16	
c. Details geographical locations to be studied, including maps where possible	Yes	Worksheets 10, 11	
d. Discusses resource and time constraints, if applicable	Yes		
A7. Quality Objectives and Criteria			
a. Identifies - performance/measurement criteria for all information to be collected and acceptance criteria for information obtained from previous studies, - including project action limits and laboratory detection limits and - range of anticipated concentrations of each parameter of interest	Yes	Worksheet 15 Worksheet 13 Worksheets 12.1 - 12.4	
b. Discusses precision	Yes	Worksheet 37	
c. Addresses bias	Yes		
d. Discusses representativeness	Yes		
e. Identifies the need for completeness	Yes		
f. Describes the need for comparability	Yes		
g. Discusses desired method sensitivity	Yes		
A8. Special Training/Certifications			
a. Identifies any project personnel specialized training or certifications	Yes	Worksheet 4, 7 & 8	
b. Discusses how this training will be provided	Yes		
c. Indicates personnel responsible for assuring training/certifications are satisfied	Yes		
d. identifies where this information is documented	Yes		
A9. Documentation and Records			
a. Identifies report format and summarizes all data report package information	Yes	Worksheets 14 & 16 Worksheet 29	
b. Lists all other project documents, records, and electronic files that will be produced	Yes	Worksheet 14 & 16	
c. Identifies where project information should be kept and for how long	Yes	Worksheet 29	
d. Discusses back up plans for records stored electronically	Yes	Worksheet 29	
e. States how individuals identified in A3 will receive the most current copy of the approved QA Project Plan, identifying the individual responsible for this	Yes	Introduction Worksheet 4 & 5	
B. Data Generation/Acquisition			

Element	Acceptable *Yes/No/NA*	Location	Comments
B1. Sampling Process Design (Experimental Design)			
a. Describes and justifies design strategy, indicating size of the area, volume, or time period to be represented by a sample	Yes	Worksheet 11, 17	
b. Details the type and total number of sample types/matrix or test runs/trials expected and needed	Yes	Worksheets 11, 17, 18	
c. Indicates where samples should be taken, how sites will be identified/located	Yes		
d. Discusses what to do if sampling sites become inaccessible	Yes	Worksheet 17	
e. Identifies project activity schedules such as each sampling event, times samples should be sent to the laboratory, etc.	Yes		
f. Specifies what information is critical and what is for informational purposes only	Yes		
g. Identifies sources of variability and how this variability should be reconciled with project information	Yes		
B2. Sampling Methods			
a. Identifies all sampling SOPs by number, date, and regulatory citation, indicating sampling options or modifications to be taken	Yes	Worksheet 21	
b. Indicates how each sample/matrix type should be collected	Yes	Worksheet 17 Worksheet 19 & 30	
c. If in situ monitoring, indicates how instruments should be deployed and operated to avoid contamination and ensure maintenance of proper data	Yes	Worksheet 22	
d. If continuous monitoring, indicates averaging time and how instruments should store and maintain raw data, or data averages	Yes	Worksheet 11, Worksheet 22	Not Continuous
e. Indicates how samples are to be homogenized, composited, split, or filtered, if needed	Yes	Worksheet 17	
f. Indicates what sample containers and sample volumes should be used	Yes	Worksheet 17, SAP Table 1 Worksheet 19 & 30	
g. Identifies whether samples should be preserved and indicates methods that should be followed	Yes	Worksheet 17, SAP Table 1 Worksheet 19 & 30	
h. Indicates whether sampling equipment and samplers should be cleaned and/or decontaminated, identifying how this should be done and by-products disposed of	Yes	Worksheet 21	
i. Identifies any equipment and support facilities needed	Yes	Worksheet 22	

Element	Acceptable *Yes/No/NA*	Location	Comments
j. Addresses actions to be taken when problems occur, identifying individual(s) responsible for corrective action and how this should be documented	Yes	Worksheet 17 Worksheet 31, 32 & 33	
B3. Sample Handling and Custody			
a. States maximum holding times allowed from sample collection to extraction and/or analysis for each sample type and, for in-situ or continuous monitoring, the maximum time before retrieval of information	Yes	Worksheet 19 & 30	
b. Identifies how samples or information should be physically handled, transported, and then received and held in the laboratory or office (including temperature upon receipt)	Yes	Worksheet 26 & 27	
c. Indicates how sample or information handling and custody information should be documented, such as in field notebooks and forms, identifying individual responsible	Yes	Worksheets 17, 26 & 27	
d. Discusses system for identifying samples, for example, numbering system, sample tags and labels, and attaches forms to the plan	Yes	Worksheet 11, 17, 18, 26 & 27	
e. Identifies chain-of-custody procedures and includes form to track custody	Yes		
B4. Analytical Methods			
a. Identifies all analytical SOPs (field, laboratory and/or office) that should be followed by number, date, and regulatory citation, indicating options or modifications to be taken, such as sub-sampling and extraction procedures	Yes	Worksheet 23	
b. Identifies equipment or instrumentation needed	Yes	Worksheets 23, 24	
c. Specifies any specific method performance criteria	Yes	Worksheet 22, 24	Worksheet 22 - Field Equipment Worksheet 24 - Analytical Instruments
d. Identifies procedures to follow when failures occur, identifying individual responsible for corrective action and appropriate documentation	Yes		
e. Identifies sample disposal procedures	Yes	Worksheet 26 & 27	
f. Specifies laboratory turnaround times needed	Yes	Worksheet 19 & 30	
g. Provides method validation information and SOPs for nonstandard methods	Yes	Worksheets 23, 25 & 28	
B5. Quality Control			
a. For each type of sampling, analysis, or measurement technique, identifies QC activities which should be used, for example, blanks, spikes, duplicates, etc., and at what frequency	Yes	Worksheet 20	

Element	Acceptable *Yes/No/NA*	Location	Comments
b. Details what should be done when control limits are exceeded, and how effectiveness of control actions will be determined and documented	Yes	Worksheets 26 & 27, Worksheet 25 & 28	
c. Identifies procedures and formulas for calculating applicable QC statistics, for example, for precision, bias, outliers and missing data	Yes	Worksheet 37	
B6. Instrument/Equipment Testing, Inspection, and Maintenance			
a. Identifies field and laboratory equipment needing periodic maintenance, and the schedule for this	Yes	Worksheets 22, 24, and 25	
b. Identifies testing criteria	Yes		
c. Notes availability and location of spare parts	Yes		If equipment fails a replacement will be obtained.
d. Indicates procedures in place for inspecting equipment before usage	Yes	Worksheets 22, 24, and 25	
e. Identifies individual(s) responsible for testing, inspection and maintenance	Yes		
f. Indicates how deficiencies found should be resolved, re-inspections performed, and effectiveness of corrective action determined and documented	Yes	Worksheets 22, 24	
B7. Instrument/Equipment Calibration and Frequency			
a. Identifies equipment, tools, and instruments that should be calibrated and the frequency for this calibration	Yes	Worksheets 22 and 24	
b. Describes how calibrations should be performed and documented, indicating test criteria and standards or certified equipment	Yes	Worksheet 22, SAP Worksheet 26 & 27	
c. Identifies how deficiencies should be resolved and documented	Yes		
B8. Inspection/Acceptance for Supplies and Consumables			
a. Identifies critical supplies and consumables for field and laboratory, noting supply source, acceptance criteria, and procedures for tracking, storing and retrieving these materials	Yes	Worksheet 26 & 27 Worksheet 22,	
b. Identifies the individual(s) responsible for this	Yes		
B9. Use of Existing Data (Non-direct Measurements)			
a. Identifies data sources, for example, computer databases or literature files, or models that should be accessed and used	Yes	Worksheet 11 Worksheet 13	
b. Describes the intended use of this information and the rationale for their selection, i.e., its relevance to project	Yes	Worksheet 11 Worksheet 13	
c. Indicates the acceptance criteria for these data sources and/or models	Yes		
d. Identifies key resources/support facilities needed	Yes		
e. Describes how limits to validity and operating conditions should be determined, for example, internal checks of the program and Beta testing	Yes	Worksheet 11 Worksheet 13	

Element	Acceptable *Yes/No/NA*	Location	Comments
B10. Data Management			
a. Describes data management scheme from field to final use and storage	Yes	Worksheets 26 & 27, Worksheets 29 & 35, Attachment B	
b. Discusses standard record-keeping and tracking practices, and the document control system or cites other written documentation such as SOPs	Yes	Worksheets 26 & 27 Worksheet 29	
c. Identifies data handling equipment/procedures that should be used to process, compile, analyze, and transmit data reliably and accurately	Yes	Worksheets 22, 23, and 29	
d. Identifies individual(s) responsible for this	Yes	Worksheet 29	
e. Describes the process for data archival and retrieval	Yes		
f. Describes procedures to demonstrate acceptability of hardware and software configurations	Yes	Worksheets 22 and 23	
g. Attaches checklists and forms that should be used	Yes	Worksheet 17 Attachment A	
C. Assessment and Oversight			
C1. Assessments and Response Actions			
a. Lists the number, frequency, and type of assessment activities that should be conducted, with the approximate dates	Yes	Worksheet 31, 32 & 33	
b. Identifies individual(s) responsible for conducting assessments, indicating their authority to issue stop work orders, and any other possible participants in the assessment process	Yes		
c. Describes how and to whom assessment information should be reported	Yes		
d. Identifies how corrective actions should be addressed and by whom, and how they should be verified and documented	Yes	Worksheet 31, 32 & 33	
C2. Reports to Management			
a. Identifies what project QA status reports are needed and how frequently	Yes	Worksheet 31, 32 & 33	
b. Identifies who should write these reports and who should receive this information	Yes	Worksheet 31, 32 & 33	
D. Data Validation and Usability			
D1. Data Review, Verification, and Validation			
Describes criteria that should be used for accepting, rejecting, or qualifying project data	Yes	Worksheet 36	
D2. Verification and Validation Methods			

Element	Acceptable *Yes/No/NA*	Location	Comments
a. Describes process for data verification and validation, providing SOPs and indicating what data validation software should be used, if any	Yes	Worksheets 34, 35, 36	
b. Identifies who is responsible for verifying and validating different components of the project data/information, for example, chain-of-custody forms, receipt logs, calibration information, etc.	Yes	Worksheet 35	
c. Identifies issue resolution process, and method and individual responsible for conveying these results to data users	Yes	Worksheets 35 Worksheet 36	
d. Attaches checklists, forms, and calculations	Yes	Worksheet 34, 37	
D3. Reconciliation with User Requirements			
a. Describes procedures to evaluate the uncertainty of the validated data	Yes	Worksheets 12, 37	
b. Describes how limitations on data use should be reported to the data users	Yes	Worksheet 37	
D3. Reconciliation with User Requirements			
a. Describes procedures to evaluate the uncertainty of the validated data	Yes	Worksheets 11 Worksheets 12, 35, 36	
b. Describes how limitations on data use should be reported to the data users	Yes	Worksheet 12	

APPENDIX B
SITE SPECIFIC DATA MANAGEMENT PLAN

Gold King Mine ER Data Management Plan

	This data management plan (DMP) is intended to provide guidance for data collection by field personnel and subsequent data management activities. The data collection and management practices presented in this plan are designed to ensure data integrity and consistency for all data collection personnel and from operational period to the next. This document is intended to be used in conjunction with the Region 8 Data Management Plan and only includes the details specific to the site.	**Site-Specific Data Management Plan**		
		Project Name:	Gold King Mine ER	**TDD Number/Site ID:**	
		Author:	Megan Oller	**Company:**	Weston Solutions
		Date Initiated:	10/9/15	**Last Updated:**	
Reviewed by: John Lucotch			**Date:** 10/9/15		

Data Processing

The following table outlines the specific requirements for various data types being collected during the project.

Data Stream[1]	Site Specific Procedure (Y/N)[2]	Required Information[3]	Data Source[4]	Site Specific Data Elements (Y/N)	QA Process[5]	Data Repository[6]	Reporting Task
Water Sampling Data	Y	*Location, sample number, sample matrix, water quality parameters*	Field logbook, water quality meter	Y	Reviewed by field personnel prior to import into scribe	Scribe.net	Results Report, Geospatial Viewer
Sediment Sampling Data	Y	*Location, sample number, sample matrix*	Field logbook, water quality meter	Y	Reviewed by field personnel prior to import into scribe	Scribe.net	Results Report, Geospatial Viewer
Photographic Data	N	*Location, date, time, description*	GPS Field Camera	N	PTL review during photo-log creation	EPAOSC.org	Site photo-log, Geospatial Viewer
Site Documents	N	*SAP, HASP, Customized data presentations*	START PTL	N	PTL and OSC Reviews	EPAOSC.org	NA
Analytical Data	N	*Chain of Custody, Laboratory Data from ESAT mobile lab*	Scribe, Laboratory EDD (in Tech Law LIMS format)	N	Review by field personnel prior to import to ensure all required fields are present and data maps accurately into scribe database (using ESAT data map)	Scribe.net	Results Report, Geospatial Viewer
Project Costs	N	*Field Costs, Personnel Hours*	Weston time track reports, ODC reports, burn sheets	N	PTL Review	RCMS database	1900 -1955 Forms, Email to OSC

Gold King Mine ER Data Management Plan

1: Category of data generated for projects (i.e. monitoring data, water sampling data, locational data, photographs, analytical data, costs, etc). Create one line per category.
2: Y – indicates a site specific procedure is employed, N – indicates data management follows procedures outlined in the R8 DMP
3: Information necessary to provide a complete data record
4: Equipment or source that denerates data (i.e. TVA 1000, camera, iPad, Trimble GPS, laboratory EDD)
5: QA process related to data, do not include analytical data validation here
6: Location of data storage (i.e. epaosc.org, scribe.net, geospatial viewer)

Attachment A
Site Specific Data Elements and Valid Values

Ref. Project: **TDD:** **Date:**

This table is provides detailed guidance for the collection of field data to be housed in the site scribe database. This table ensures site data is collected consistently across field teams and field events. This table exists in the Region 8 DMP with all of the default data elements and valid values – refer to DMP appendix A1 for a complete copy. Complete this table for data elements and valid values that are specific to your site. You may copy in lines that are especially important for your site data management or specify where you only want to use a limited list of the general valid values.

Data Element	Required	Description	Format	Scribe Table.Field	Valid Values*
Location	Yes	Identifier for a geographic point where samples or monitoring results are collected. Must be unique within a Site.	Text (30)	Location.Location	GKM##
LocationDescription	Yes	Brief description of a geographic point where samples or monitoring results are collected. Includes previously sampled nomenclature	Text (100)	Location. LocationDescription	Example: Toe of Gold King Mine Waste Dump, CC01C, CC19, etc.
SampleID	Yes	Identifier for a sample that is collected. Must be unique within a Site	Text (25)	Samples.Samp_No	LocationID_mmddyy
Matrix	Yes	Matrix that is sampled.	Valid Values	Samples.Matrix	Water, Soil, Sediment
SampleCollection	Yes	The category of sample that is collected.	Valid Values	Samples.SampleCollection	Grab, Composite
SampleType	Yes	The category of Quality Control sample that is collected in the field (if appropriate).	Valid Values	Samples.SampleType	Field Sample, Blank, Duplicate
SampleDate	Yes	Date when a sample is collected. If a sampling duration is involved, enter the beginning date for this activity.	Date (MM/DD/YY)	Samples.SampleStartDate	
SampleTime	Conditional	Time when a sample is collected. If a sampling duration is involved, enter the beginning time for this activity. Required if Sample End Time is provided.	Time (24HH:MM:SS)	Samples.SampleStartTime	
Sample Media		Specification of sample matrix	Valid Values	Samples.SampleMedia	Surface Water, Sediment, Biota

* Fill in additional site specific data elements/ valid values if identified in the field

NOTE: This table is meant to provide detailed guidance for the collection of field data to be housed in the site scribe database. This table ensures site data is collected consistently across field teams and field events. This table exists in the Region 8 DMP with all of the default data elements and valid values. You only have to fill out this table for data elements and valid values that are specific to your site. You may copy in lines that are especially important for your site data management or specify where you only want to use a limited list of the general valid values.

APPENDIX C
POST-GOLD KING MINE RELEASE INCIDENT CONCEPTUAL MONITORING PLAN FOR SURFACE WATER, SEDIMENTS AND BIOLOGY

Post-Gold King Mine Release Incident: Conceptual Monitoring Plan for Surface Water, Sediments, and Biology

EPA Draft

September 2015

I. Background – Gold King Mine Release Incident and Animas River Watershed Historic Conditions

On August 5, 2015, EPA was conducting an investigation of the Gold King Mine (GKM) near Silverton, Colorado to assess the on-going water releases from the mine, treat mine water, and assess the feasibility of further mine remediation. While excavating above an old adit, pressurized water began leaking above the mine tunnel, spilling about three million gallons of water stored behind the collapsed material into Cement Creek, a tributary of the Animas River (http://www2.epa.gov/goldkingmine). The Animas River originates in the mountain peaks northeast of Silverton, in San Juan County, Colorado. It ends in Farmington, New Mexico, where it empties into the San Juan River terminating in Lake Powell in Utah. The conceptual monitoring strategy outlined in this document is designed to collect data in these surface waterbodies potentially impacted by the GKM Release Incident. Because this watershed has been historically impacted by mining releases and natural mineralization and these releases continue today, difficulties exist in identifying and distinguishing potential impacts of the GKM Release Incident from the many other ongoing sources of impacts described in this section.

The upper reaches of the Animas watershed are heavily impacted by historic mining activities and natural mineralization. Many abandoned mines exist within a two-mile radius in the headwaters including: the Upper Gold King, American Tunnel, Grand Mogul, Mogul, Red and Bonita, Eveline, Henrietta, Joe and John, and Lark mines. Some of these mines have acid mine drainages that produce flows of between 30 and 300 gallons per minute that directly or indirectly enter Cement Creek and eventually reach the Animas River. These flows were occurring prior to the GKM Release Incident and are ongoing. As a result, numerous remediation activities have been initiated in the watershed. The Animas River Stakeholder Group, the Bureau of Land Management, the Colorado Division of Reclamation/Mining and Safety, and EPA Region 8 have completed remediation projects in the watershed (EPA Region 8, Upper Animas Mining District: Draft Baseline Ecological Risk Assessment, http://www2.epa.gov/region8/upper-animas-mining-district-draft-baseline-ecological-risk-assessment). The Colorado Department of Public Health and the Environment has developed more than twenty-five Total Maximum Daily Loads (restoration plans required for waterbody segments considered impaired under the Clean Water Act) to help guide restoration activities towards meeting water quality standards. However, for some waters, including Cement Creek, the State has followed procedures under the Clean Water Act to remove aquatic life support as a designated use for the waterbody because it is not an attainable goal (Colorado Department of Public Health & Environment, https://www.colorado.gov/pacific/cdphe/tmdl-san-juan-and-dolores-river-basins).

Though restoration activities and plans have been underway in the watershed, aquatic life uses in numerous segments of the watershed remain impaired by heavy metals (Colorado Department of Public Health & Environment, https://www.colorado.gov/pacific/sites/default/files/Regulation-93.pdf). The Animas River Stakeholders Group (ARSG), which updated a watershed plan for remediating historical mining sites in the Upper Animas River Basin in 2013, estimates that in recent years untreated acid mine drainage from Cement Creek alone has been in the range of 600-800 gallons per minute or about 314-420 million gallons per year, with increases in metals loadings observed 40 miles downstream

in the Animas River
(http://ofmpub.epa.gov/apex/grts/f?p=110:700:13401198170892::NO:RP,700:P700_PRJ_SEQ:62860).

This document describes post-release surface water quality, sediment quality, and biological community monitoring that will occur over the course of the year following the GKM Release Incident. Data collected over the next year will support an assessment of the changes in surface water and sediment quality since the GKM Release Incident across the full range of seasonal flow conditions. While this plan focuses on surface water and sediment quality, EPA is exploring a sampling regime for private drinking water wells. As part of its response to the GKM Release Incident, EPA has collected and tested more than 650 samples from private drinking water wells. The EPA is following up on 3 wells with exceedances of maximum contaminant limits (MCLs) for drinking water to determine if there is any connection to the GKM release. Currently, sampling of drinking water wells is not included in this plan. Recognizing continued interest, EPA is taking comment and input on whether further action is needed on private wells. The EPA would like stakeholder input on the frequency, duration, location and scientific basis for continuing sampling of private wells.

II. Context for Conceptual Monitoring Plan and Data Uses

This is a conceptual monitoring plan in that it outlines the objectives, boundaries, and guiding principles for this effort. This allows for stakeholder review and input prior to finalization of more detailed documents. It is not intended to replace a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan; but rather, serves to direct the development of such.

The monitoring effort described in this document will gather comprehensive data that span the watershed potentially affected by the GKM Release Incident. These data may be useful for a variety of purposes for the EPA, States, Tribes, and stakeholders and serve to increase our understanding and characterization of conditions across the watershed. A variety of media will be sampled and the objectives of this study are described in Section III. This monitoring and associated assessment will not constitute characterization for the Clean Water Act (CWA) Section 303(d) and 305(b) assessment determinations or site assessment/remedial investigation purposes under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); however, these data may support such efforts. The EPA may use a variety of regulatory and response authorities to conduct studies, initiate cleanup actions, facilitate public participation, and otherwise contribute to the cleanup of watersheds contaminated with hazardous substances and wastes. The EPA has developed guidance for federal and state program managers on integrating waste and water program to restore watersheds, which can be found here: http://www.epa.gov/superfund/resources/pdfs/cross-program.pdf

This monitoring study is designed to collect data in the surface waterbodies potentially impacted by the GKM Release Incident to determine if water and sediment quality trends are similar to trends observed before the GKM release. While the latest monitoring information after the GKM Release Incident shows contaminant levels have returned to pre-spill levels, this study's monitoring information will serve to inform if these findings remain consistent across the range of annual flow conditions.

It is important to recognize that the information collected for this monitoring study may not be sufficient to attribute elevated contaminant levels or possible biological metrics to the August 5, 2015, GKM release. The limits of this study's data to provide release-specific attribution follow from the many years of historic mine drainage releases from the GKM, the ongoing acid mine drainage releases from other mines into the Animas River (and downstream water bodies) and the limited availability of pre-release water quality conditions.

Monitoring and assessment efforts occurring prior to the GKM Release Incident identified pre-existing impairments to water quality, sediment quality, and biological communities in this watershed. Numerous sources of metals contamination are present that have impacted environmental quality before the GKM Release Incident and continue to impact environmental quality post GKM Release Incident. Therefore, our ability to determine if current environmental impacts relate to the GKM Release Incident is confounded by the presence of these other sources, and typical conditions in many areas of this watershed are not pristine nor free of impairments. Any new data that are gathered can only be understood with respect to the GKM Release Incident by a comparison to previous conditions that reflect historic impairment sources. Hence, the ease of interpretation of data gathered under this strategy greatly depends on the amount and quality of historic data that are available for comparison. Sites, media, and analytes for which there are robust historic datasets for pre- and post-release comparison will be the most useful in understanding whether typical conditions in this watershed are being maintained after the GKM Release Incident. A comparison of current data to data collected under pre-release/historic conditions should allow for an understanding of whether there are changes in water quality and sediment quality trends post-GKM Release Incident over the next year or whether typical conditions are witnessed. Biological data are being collected as well; however, historic datasets are more limited and biological data are more difficult to interpret and compare. Therefore, the primary media to be used in determining maintenance of pre-release or historic conditions are surface water and sediment.

Some sites that do not have robust datasets will be sampled because they are necessary to provide a more complete geographic distribution of data collection under this strategy. Data for sites, media, and analytes, for which there is not a historic dataset for comparison, will not be useful for determining changes in environmental quality as a result of the GKM Release Incident and should not be used to this end. However, these data are important for increasing our understanding and characterization of the watershed with respect to the many complex existing contaminant sources and stressors that have been and continue to be present. These data serve to inform stakeholders of the environmental conditions across the wider watershed, begin the development of a historic data set for more locations in the watershed, and provide valuable information for decision makers.

After completing one year of monitoring under this plan, if results indicate a return to pre-release/historic trends, monitoring efforts under this plan will end and routine monitoring will continue per State, Tribal, and Federal program strategies and priorities. If pre-release/historic trends across the watershed are not maintained at some locations in the watershed, the EPA will conduct additional site-specific investigations as appropriate and use its authorities to work with other federal agencies, States, Tribes, and local entities to address these problems. The EPA is coordinating with its regulatory partners and affected stakeholders to understand other organizations' monitoring efforts, prevent duplication, and promote data sharing.

III. Objectives and Study Questions

This document outlines EPA's proposed conceptual monitoring strategy, assessment goals and general methods for evaluating surface waters, sediments, and biological communities downstream of the GKM Release Incident. This document outlines monitoring to be undertaken by the EPA and key stakeholders or regulatory partners that will support collaborative assessment of the pre- and post-release conditions. States and Tribes may consider this a framework for additional sampling that they wish to undertake.

The objectives of the monitoring strategy are limited in scope by the availability of historic or pre-release data. In this document pre-release data include results of sampling that occurred just prior to the GKM Release Incident. Historic data include longer term data sets that reflect many years of sampling and contaminant trends. Pre-release and historic data for metals in sediment, metals in water and biological assemblages are available for the Animas River in Colorado and Southern Ute Indian Reservation due to proximity of mine locations and past and continued interest in the effects of mining run-off. However, pre-release and historic data for both metals in sediment and water as well as biological information are less abundant further downstream on the Animas and San Juan River in New Mexico, Ute Mountain Ute Reservation, the Navajo Nation, and Utah. Due to the discrepancy of available pre-release and historic data and potential challenges faced by downstream states in assessing pre-release/historic trends with post-release conditions, two objectives for this study are proposed:

- Objective A: Identify changes in surface water or sediment quality trends since the GKM Release Incident in Cement Creek, Animas River, and the San Juan River by comparing post-release data against pre-release or historic trends. Only data that meet the requirements of Objective A, in that pre-release and post-release comparisons can be made, will be used to assess the changes since the GKM Release Incident.
- Objective B: Assess only current conditions of Cement Creek, Animas River, San Juan River, and Lake Powell where historic or pre-release data are absent or limited. Data solely collected to meet Objective B will not be sufficient in assessing the changes since the GKM Release Incident without additional information.

Objective A: Identify changes in surface water or sediment quality trends since the GKM Release Incident in Cement Creek, Animas River, and the San Juan River at sites in Colorado, Southern Ute Reservation, New Mexico, Ute Mountain Ute Reservation, Navajo Nation, and Utah by comparing post-release data against pre-release or historic trends for all sampling sites possible. Only data that meet the requirements of Objective A, in that pre-release and post-release comparisons can be made, will be used to assess the changes since the GKM Release Incident. Include biological community and biological tissue data-set comparisons if historic datasets allow.

The primary purpose of this objective is to identify changes since the GKM Release Incident that occurred on August 5, 2015 by comparing post-release data against pre-release or historic trends for each sampling location. The study questions identified below provide the context used in selecting sampling locations and analytes of interest for this objective.

For this effort, it is necessary that data be collected at sites for which historic and/or pre-release data trends are available so that historic and/or pre-release trends may be compared to the data collected through this monitoring effort. Potential sampling locations are identified in this document with emphasis placed on those sites for which historic data are available. Pre-release and historic data availability are understood for most of these potential sites or will be compiled and analyzed prior to final site selection. Stakeholders may have alternative (replacement) sites of interest for those identified in Table 2.

Assessment Objective A:

Compare pre-release (or historic) and post-release surface water data, sediment data and biological data of Cement Creek, the Animas River, and the San Juan River.

Study Questions – Objective A:

1. Have water and sediment quality trends in Cement Creek, the Animas River, and the San Juan River changed since the GKM Release Incident?
    a. What are the water column and sediment metals concentrations/loadings and how do they compare to pre-release or historic trends?
    b. What are the conditions of the biological communities, macroinvertebrates and fish, and how do the indices used to assess them compare to pre-release or historic conditions?
2. If post-release conditions are of lower quality than pre-release/historic trends, are water quality standards or screening levels exceeded for human health (including recreation and fish consumption), agricultural, and aquatic life uses in the watershed?
    If metals concentrations in sampled media are higher than pre-release/historic trends, are they meeting screening levels identified as acceptable for recreation, agriculture, and aquatic life? Screening levels that may be used by EPA include those benchmarks identified as part of the GKM Release Incident emergency response and other water quality standards that apply.

Objective B: Assess only current conditions of the Animas River, San Juan River, and Lake Powell at locations in Colorado, Southern Ute Reservation, New Mexico, Ute Mountain Ute Reservation, Navajo Nation, and Utah at sites in which historic or pre-release data are absent or limited. Data solely collected to meet Objective B will not be sufficient in assessing the changes since the GKM Release Incident without additional information.

At stations that lack historical or pre-release data, a general assessment is proposed for Cement Creek, Animas River, San Juan River and including Lake Powell. The general assessment will not identify changes since the release but can be used to better understand overall conditions at these sites, which reflect all previous releases, discharges, spills, stormwater runoff and erosion over previous decades.

Assessment Objective B:

Identify current conditions of Cement Creek, Animas River, San Juan River and Lake Powell through the collection of surface water, sediment, and biological samples at multiple locations.

Study Questions – Objective B:

1. Do surface water and sediment in Cement Creek, Animas River, San Juan River and Lake Powell demonstrate exceedances of current criteria for metals and/or screening levels?
    a. What are current metals in water concentrations and how do they compare to state water quality standards and/or screening levels?
    b. What are current metals in sediment concentrations and how do they compare to recreational screening levels?
    c. What is the current assessment of biological communities (macroinvertebrates and fish) for locations in which State/Tribal assessment methods are available?
    d. How do current assessments compare to previous assessments (if available)?

IV. Monitoring Frequency and Analytes of Interest

The EPA anticipates that the sampling under this strategy will occur during the first year after completion of the GKM Release Incident response monitoring activities conclude. This monitoring and assessment effort will end after approximately one year if data confirm that pre-release trends or screening levels are maintained. A one-year monitoring duration was selected so that data may be collected across the full range of seasonal flow conditions. After completing one-year of monitoring under this plan, if results indicate a return to pre-release/historic trends, monitoring efforts under this plan will end and routine monitoring will continue per State, Tribal, and Federal program strategies and priorities. If pre-release trends are not attained and screening levels are exceeded, monitoring activities will be focused site specifically on areas of interest with the purpose of identifying sources and developing corrective actions. Potential sampling locations are identified below in Table 2, Section VI.

Table 1 summarizes the expected frequency of monitoring under this plan as well as the type of data to be collected. The full suite of metals that were monitored during the emergency response will be monitored under this strategy for consistency. However, not all of the metals monitored during the emergency response (and through this effort) are expected to be present in the GKM discharge. The primary metals of interest associated with the GKM include: aluminum, cadmium, copper, iron, lead, manganese, and zinc.

Table 1. Sampling and Monitoring Schedule For Potential Sampling Sites Listed in Table 2					
SAMPLING AND MONITORING SCHEDULE:	FALL 2015	MARCH 2016	SPRING/ JUNE 2016	SUMMER 2016	FALL 2016
WATER COLUMN - dissolved and total recoverable metals[1], dissolved organic carbon (DOC), total organic carbon (TOC), hardness	1 event	1 event: pre-snow melt	1 event: snowmelt runoff		1 event: low flow
SEDIMENT – total recoverable metals	1 event	1 event: pre-snow melt			1 event: low flow
BENTHOS AND FISH TISSUE – metals; Collect and assess in locations where historic data are available so that release effects can be assessed.					1 event: timeframe comparable to historic data
BIOLOGICAL COMMUNITY – benthic macroinvertebrate and fish populations – Collect and assess in locations where historic data are available and State/Tribal assessment methods are developed so that release effects can be assessed.	1 event				1 event
STORMWATER SAMPLING - dissolved and total recoverable metals[1] and dissolved organic carbon (DOC) – Collect at sites on Animas in CO, Southern Ute, NM	1-2 (total across Fall 2015 and Summer 2016)			1-2 (total across Fall 2015 and Summer 2016)	
PHYSICAL HABITAT	Collected once at each site sampled for macroinvertebrates and fish – likely at fall event				
FIELD PARAMETERS –	All sampling events will include field parameters (pH, temperature, dissolved oxygen (DO), conductivity and turbidity) measured with a probe/sonde.				
FLOW –	Flow data will be measured via stream gage if present or by flow meter for all events.				
[1] Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, uranium, vanadium, and zinc					

V. Site Selection and Assessment Approach

The following summarizes the site selection and general assessment approach for the watershed.

Sampling and monitoring location selection:

Currently, the EPA has identified 23 potential monitoring locations along Cement Creek, the Animas River, the San Juan River, and Lake Powell based upon locations used in the emergency response and long-term data availability. Reference/background sites necessary for state or tribal assessments may be necessary and require stakeholder input for identification. The detailed list of potential sampling locations is provided in Section VI, Table 2.

Assessment Summary:

For data interpretation, post-release monitoring data will be compared against historic data, pre-release metals levels, risk-based screening levels and/or applicable water quality standards. Biological community information will be compared against pre-release/historic data using State/Tribal assessment methods. Data assessment methods will be developed for each site based upon the quantity and quality of the historic data. For sites with more abundant historic data, a statistical analysis of pre- and post-release conditions may be possible. Sites with limited historic data may not be suitable for a statistical comparison of pre- and post-release conditions and may provide only a qualitative understanding of changes in water and sediment quality. For these sites, changes in impairment status under the Clean Water Act pre- and post-release may serve to inform whether further study is warranted for confirmation. It is anticipated that the following decision rules will apply:

General Decision Rules (primarily to be based on metals concentrations in water and sediment):

- If the one-year monitoring study indicates that pre-release water quality and sediment trends are similar to trends observed prior to the GKM release:
  - End monitoring under this plan and continue monitoring per State, Tribal, and Federal program strategies and priorities.; and
  - Communicate waterbody condition in comparison to water quality standards and/or screening level benchmarks to stakeholders.
- If the one-year monitoring study indicates that pre-release water quality and sediment trends have degraded since the GKM release AND screening levels or water quality standards are exceeded:
  - The EPA will conduct additional site-specific investigations as appropriate and use its authorities to work with other federal agencies, States, Tribes, and local entities to address these problems.
- If the monitoring data for any site cannot be compared to pre-release conditions/historic data:
  - Communicate waterbody condition in comparison to water quality standards and/or screening level benchmarks to stakeholders. Conditions will not be attributable to GKM Release Incident using these data alone.

Screening Levels and Water Quality Standards:

Screening levels that were used for the GKM Release Incident response decisions will be used in data assessment under this strategy as well. Federally approved applicable State and Tribal water quality standards can be found at:

- State of Colorado –
  - ftp://ft.dphe.state.co.us/wqc/wqcc/Current%20Water%20Qualitly%20Standards/Currently%20Effective%20Standards/34_SanJuan_Effective_06-30-2015/34_2015(06)SBP.pdf
- Navajo Nation –
  - http://www.navajonationepa.org/Pdf%20files/Navajo%20Nation%20Surface%20Water%20Quality%20Standards%202007.pdf
- Southern Ute Tribe -
  - Contact the tribe - https://www.southernute-nsn.gov/environmental-programs/water-quality/ or EPA Region 8 – 303-312-6947
- State of New Mexico –
  - http://164.64.110.239/nmac/parts/title20/20.006.0004.pdf
- State of Utah –
  - http://www.rules.utah.gov/publicat/code/r317/r317-002.htm
- Ute Mountain Ute Tribe –
  - http://www.utemountainuteenvironmental.org/umep/assets/File/Water/Surface%20Water%20Standards/UMU_WQS_2011Revision_042011_supplimental.pdf

VI. Potential Sampling Locations

Table 2 includes potential sampling locations for the monitoring described in this plan. Final site selection will be based upon the assessment needs and goals of EPA, key stakeholders and regulatory partners. Replacement sites with pre-release or historic data may also be considered. Section XI provides associated maps for these locations. Maps will be finalized once site selection is complete.

Table 2. Potential site names, description and type

Site Name	Latitude	Longitude	Description/Location	Importance/Rationale
CC48 (EPA) / 09358550 (USGS)	37.819984	-107.663275	Cement Creek upstream of Silverton	Historic, long-term data record and release data available
A68 (EPA) / 09358550 (USGS)	37.811202	-107.659167	Animas River above Cement Creek in Silverton	Reference condition for this release; historic, long-term data record and release data available
A72 (EPA) / 82 (WQCD) /09359020 (USGS) / 3611 (RW)	37.79027	-107.667578	Animas River at gage below Silverton, downstream of confluence with Mineral Creek	Historic, long-term and release data record available

A73 (EPA) / 3442 (RW)	37.72215833	-107.65482778	Animas River upstream of Elk Creek	Historic, long-term data available; characterizes Animas before tributary influence
A75D (EPA) / 3438 (RW)	37.59793424	-107.77532681	Animas River upstream of Cascade Creek	Historic, long-term data record; characterizes Animas before tributary influence
Bakers Bridge (EPA) / GKM02 (EPA) / 88 (RW)	37.454134	-107.801601	Animas River at Bakers Bridge (CO Hwy. 250)	Historic, long-term and release data record available; pre-release water quality data available
9426 (WQCD) / 89 (RW)	37.38506	-107.83686	Animas River near Trimble at CO Hwy 252 Bridge	Historic, long-term data record available; mid-way between Bakers Bridge and Durango
32nd St. Bridge (EPA) / 3577 (RW) / 371759107520601 (USGS)	37.299991	-107.868199	Animas River in Durango at 32nd St. Bridge	Historic, long-term and release data record available
Animas – Rotary Park (EPA) / 91 (RW) / 09361500 (USGS)	37.280718	-107.876927	Animas River at Rotary Park in Durango	Historic, long-term and release data record available
GKM05 (EPA)	37.268704	-107.885857	Animas River, south end of Durango near intersection of 160 and 550 above confluence with Lightner Creek	Release response site; unclear if long-term data available
GKM01 (EPA) / AR19-3 (SUIT) / Purple Cliffs (EPA) / 371319107515001 (USGS) / 3430 (RW) / 92 (RW) / NAR1 (SUIT)	37.221542	-107.859455	Animas River at Southern Ute Reservation boundary	Release response site; at CO/S. Ute Reservation border
AR 7-2 (SUIT) / NAR4 (SUIT)	37.084992	-107.878383	Animas River above confluence with Florida River	Historic data available
NAR 6 (SUIT)	37.024806	-107.8738	Animas River on Southern Ute Reservation just downstream of Heaven on Earth Road	Long-term data available, pre-release data available

ADW-022 (EPA)	36.920559	-107.909909	Animas River at the Aztec Domestic Water System Intake	Pre-release data available
ADW-010 (EPA) / 09364010 (USGS / 28.1 (NM) / 27.8 (NM)	36.837463	-107.991684	Animas River, mid-way between Southern Ute boundary and confluence with San Juan River	Pre-release data available
FW-040 (EPA)	36.783635	-108.102111	Animas River at confluence with San Juan River	USGS historic data available
SJLP (EPA)	36.73588701	-108.2539868	San Juan River below confluence with Animas River	Pre-release data available
SJFP (EPA) / NMRM-1005 (EPA) / 09367540 (USGS)	36.74815602	-108.4120157	San Juan River near Farmington, NM	Pre-release data available; historic data (National Rivers and Streams Monitoring Assessment) available
SJSR (EPA) / 09368000 (USGS)	36.78162422	-108.6927838	San Juan River near Shiprock, NM	Pre-release data available
SJ4C (EPA) / 09371010 (USGS / 4954000 (UT)	37.000777	-109.029577	San Juan River just north of Four Corners on Ute Mountain Ute Reservation	Pre-release data available
SJME (EPA) / UTR9-0901 (EPA)	37.21681097	-109.19615	San Juan River near the confluence of McElmo Creek	Historic data (National River and Streams Monitoring Assessment) available; pre-release data available
SJBB EPA) / UTRM-1009 (EPA) / 4953250 (USGS)	37.257527	-109.618941	San Juan River at Bluff, UT	Historic data available (National Rivers and Streams Monitoring Assessment and State of Utah); pre-release and response data available
SJIN (EPA) / 371248110395301 (USGS) / 5952590 (UT)	37.2536	-110.6632	Lake Powell site near San Juan inlet	Lake Powell site

Table 3 identifies historic data availability by site data type. Data availability will be confirmed prior to final site selection.

Table 3. Summary of historic data availability by site. Asterisks indicate immediately pre-release data are available.

Site	Water column - metals	Sediment - metals	Fish tissue - metals	Benthic tissue - metals	Macro-invertebrate population	Fish population
CC48	Yes	Yes	TBD	TBD	TBD	TBD
A68	Yes	Yes	TBD	Yes	Yes	TBD
A72	Yes	Yes	TBD	Yes	Yes	TBD
A73	Yes	Yes	TBD	TBD	TBD	TBD
A75D	Yes	Yes	TBD	Yes	Yes	TBD
Bakers Bridge	Yes*	Yes	TBD	Yes	Yes	TBD
9426	Yes	No	No	No	Yes	TBD
32nd St. Bridge	Yes*	Yes	No	No	Yes	TBD
Animas – Rotary Park	Yes	Yes	TBD	TBD	Yes	TBD
GKM05	Yes	TBD	No	TBD	TBD	TBD
GKM01	Yes*	TBD	No	TBD	TBD	TBD
AR7-2	Yes	Yes	TBD	TBD	Yes	TBD
NAR6	Yes*	TBD	TBD	TBD	TBD	TBD
ADW-022	TBD	TBD	TBD	TBD	TBD	TBD
ADW-010	Yes*	TBD	TBD	TBD	TBD	TBD
SJLP	Yes*	TBD	TBD	TBD	TBD	TBD
FW-040	TBD	TBD	TBD	TBD	TBD	TBD
SJFP	Yes*	TBD	Yes	TBD	Yes	Yes
SJSR	Yes*	TBD	TBD	TBD	TBD	TBD
SJ4C	Yes*	TBD	TBD	TBD	TBD	TBD
SJME	Yes*	TBD	Yes	TBD	Yes	Yes
SJBB	Yes*	TBD	Yes	TBD	Yes	Yes
SJIN	TBD	TBD	TBD	TBD	TBD	TBD

VII. Methods

The following analytical and field methods are proposed for sample collection and analysis under this monitoring strategy:

1. Dissolved metals in water:
   - ICP-MS Dissolved Metals in Water (EPA 200.8) and ICP Dissolved Metals in Water (EPA 200.7)
2. Total recoverable metals in water:
   - ICP-MS Total Metals in Water (EPA 200.8) and ICP Total Metals in Water (EPA 200.7)

3. Mercury:
   - EPA 245.1
4. Dissolved organic carbon (DOC):
   - EPA 415.2
5. Total organic carbon (TOC):
   - EPA 415.1
6. Hardness:
   - SM 2340B
7. Total recoverable metals in sediment:
   - ICP-MS Total Metals in Soil (EPA 200.8) and ICP Total Metals in Soil (EPA 200.7)
8. Field methods:
   - EPA Sampling Standard Operating Procedures: Emergency Response Team (ERT) Standard Operating Procedures (SOPs) for surface water and sediment.
   - EPA Region 8 Water Sampling Standard Operating Procedure (SOP) and Sediment Sampling SOP.
   - EPA ERT SOPs general website: http://www.epaosc.org/site/site_profile.aspx?site_id=2107
   - Surface water sampling SOP: http://www.epaosc.org/sites/2107/files/2013-R00.pdf
   - Sediment sampling SOP: http://www.epaosc.org/sites/2107/files/2016-R00.pdf
   - Macroinvertebrate sampling options – methods may vary by location
     - Use method used for historical data collection for historical comparability
     - Use EPA's National Rivers and Streams Survey Methods for longitudinal comparability
   - Fish community sampling options – methods may vary by location
     - Use method used for historic/pre-release data collection for pre-release/historic comparability
     - Use EPA's National Rivers and Streams Survey Methods for longitudinal comparability
   - Habitat Assessment options – methods may vary by location
     - Use method used for historical data collection for historic comparability
     - EPA's National River and Streams Survey Methods for longitudinal comparability
   - Fish tissue sampling – methods may vary by location
     - Use method used for historic data collection for historic comparability

VIII. Quality Assurance/Quality Control

A QAPP will be developed to describe the data quality objectives, the detailed sampling and analysis plan, field and laboratory quality control requirements, data handling and storage, standard operating procedures for field and laboratory activities, and other quality assurance requirements for this monitoring plan. This QAPP will conform to QA/R-5 EPA Requirements for Quality Assurance Project Plans.

The EPA anticipates using a single, National Environmental Laboratory Accreditation Conference (NELAC)-accredited lab that conforms to American National Standard ASQ/ANSI E4 quality assurance systems. Split samples may be provided to a second accredited laboratory for analytical verification.

IX. Data Management

The EPA anticipates using a single lab for metals analysis in order to facilitate data delivery and sharing. We also anticipate using an online SCRIBE database to share data and uploading the data to the EPA's STORET data warehouse for long-term storage.

X. Data Assessment

Objective A of this monitoring effort is to identify changes in metals concentrations in surface water and sediment since the GKM Release Incident in Cement Creek, Animas River, and San Juan River for at least one year after the end of the emergency response. Data assessment is described generally in Section V. Additional detail regarding data assessment approaches will be included in the Quality Assurance Project Plan and Sampling and Analysis Plan. Data assessment methods will be developed for each site based upon the quantity and quality of the historic data. For sites with more abundant historic data, a statistical analysis of pre- and post-release conditions may be possible. Sites with limited historic data may not be suitable for a statistical comparison of pre- and post-release conditions and may provide only a qualitative understanding of changes in water and sediment quality. For these sites, changes in impairment status under the Clean Water Act may serve to inform whether further study is warranted.

When completing condition assessments for either Objective A or Objective B, State and tribal assessment methods will be considered in assessing data against water quality standards. Available assessment methods include the following:

- State of Colorado –
  - https://www.colorado.gov/pacific/sites/default/files/303dLM2016.pdf
- State of New Mexico –
  - https://www.env.nm.gov/swqb/protocols/documents/2016_FINAL_AP_062215.pdf
- State of Utah –
  - http://www.deq.utah.gov/ProgramsServices/programs/water/wqmanagement/assessment/docs/2015/03Mar/303d_AsseesmentMethodology.pdf

XI. Figures

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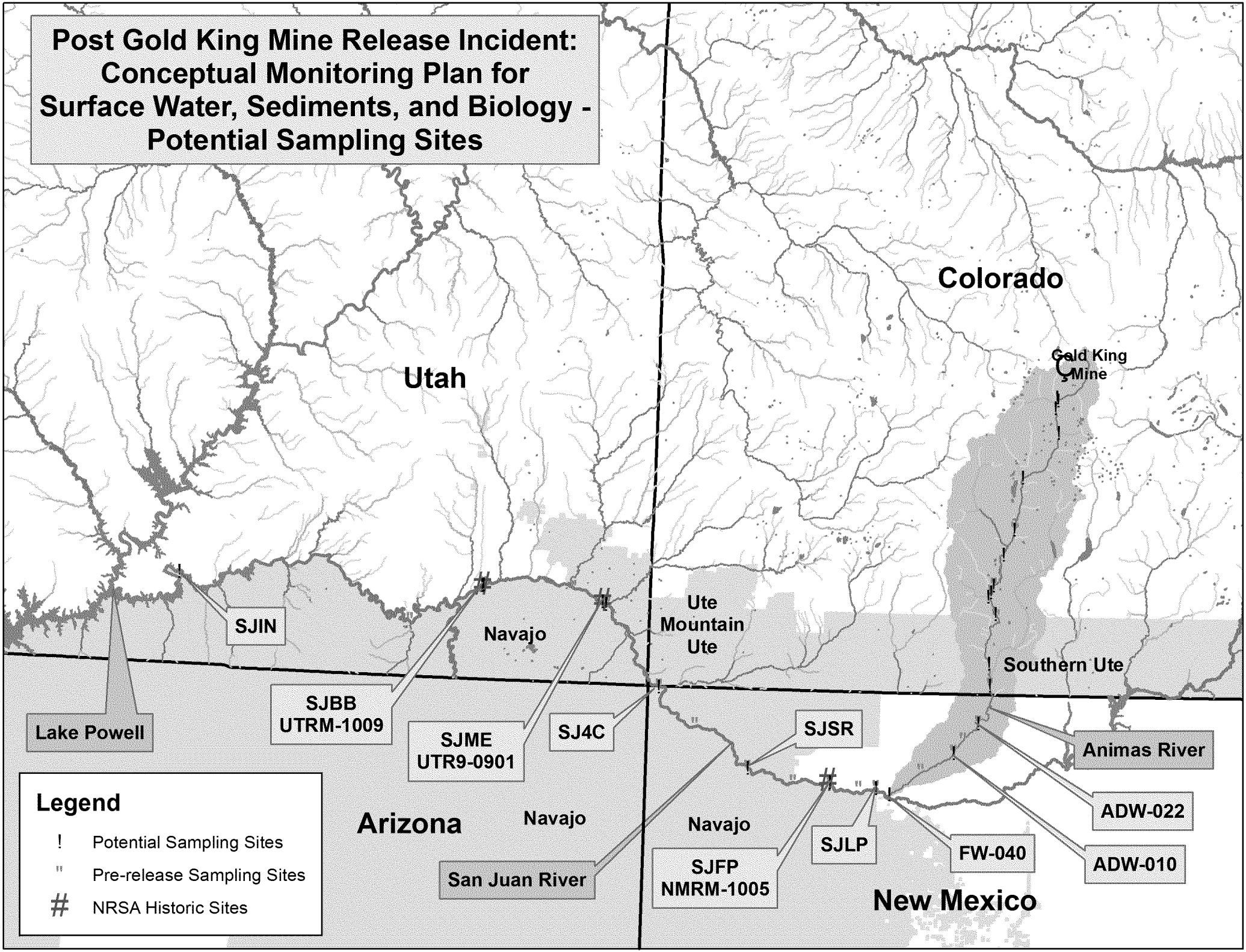

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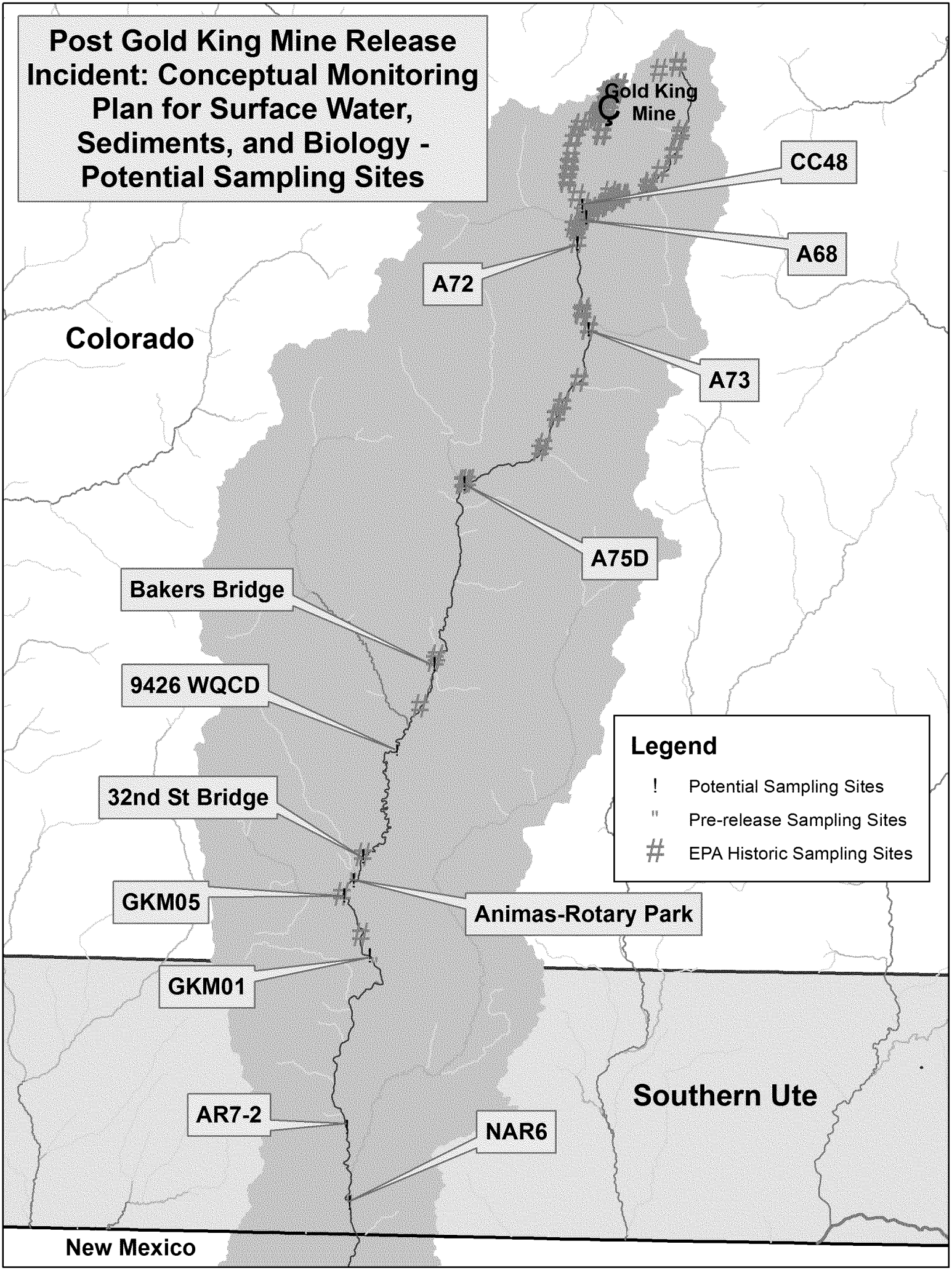
Post Gold King Mine Release Incident: Conceptual Monitoring Plan for Surface Water, Sediments, and Biology - Potential Sampling Sites
Gold King Mine
CC48
A68
A72
A73
A75D
Colorado
Bakers Bridge
9426 WQCD
32nd St Bridge
GKM05
Animas-Rotary Park
GKM01
AR7-2
NAR6
Southern Ute
New Mexico
Legend
! Potential Sampling Sites
" Pre-release Sampling Sites
EPA Historic Sampling Sites